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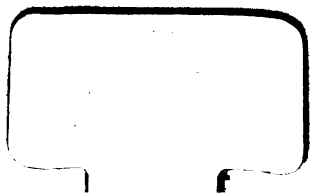
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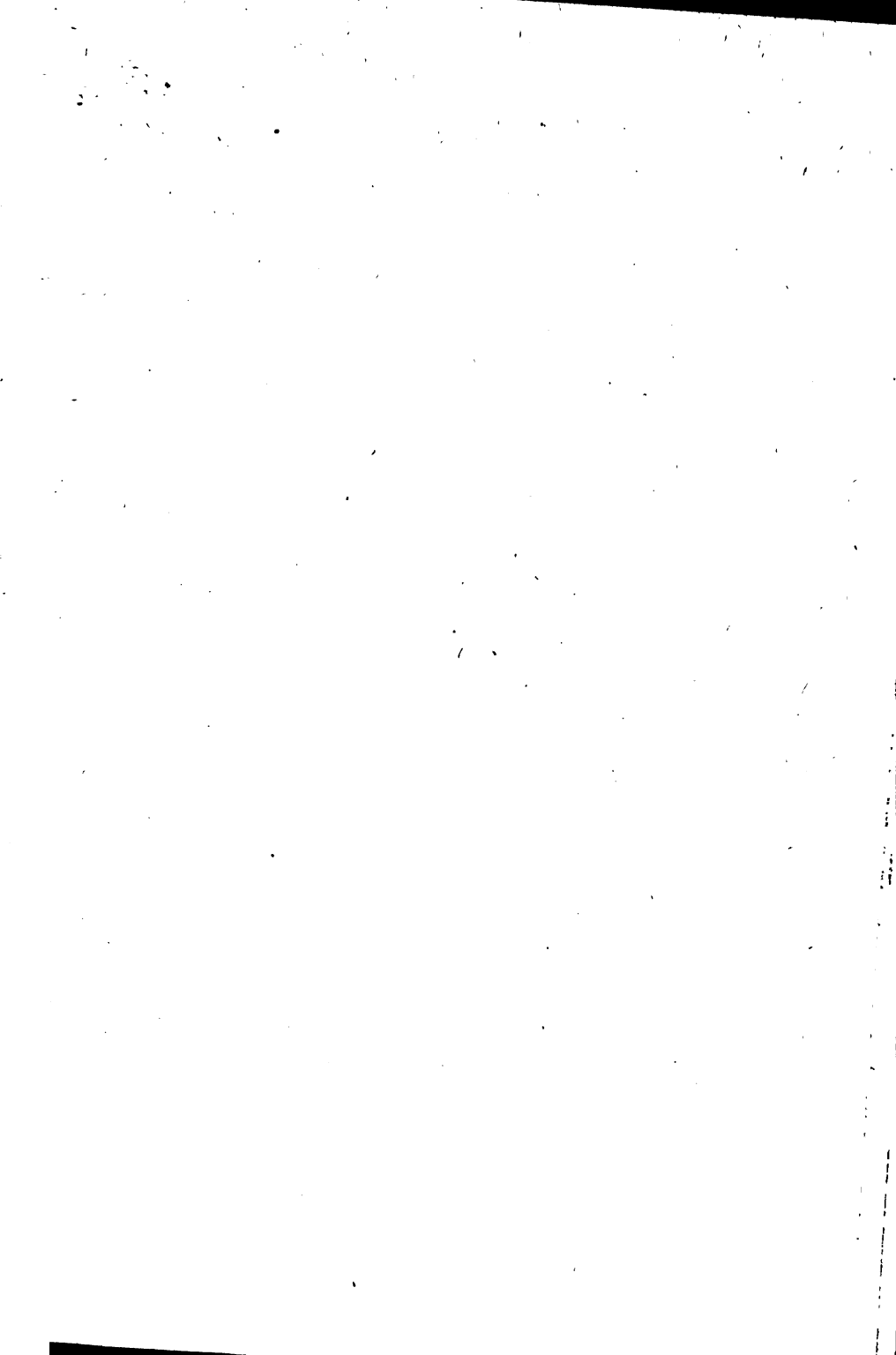
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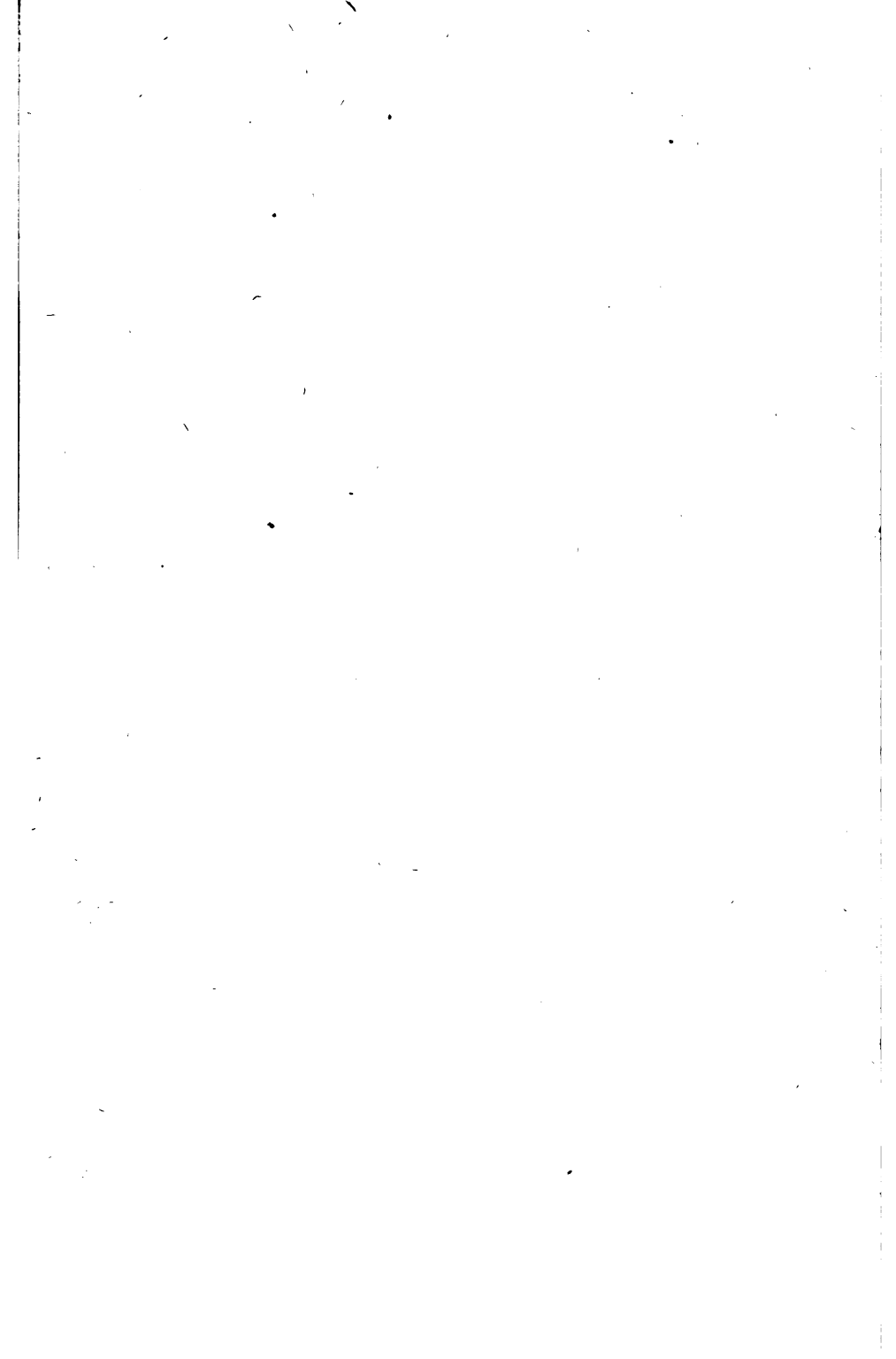
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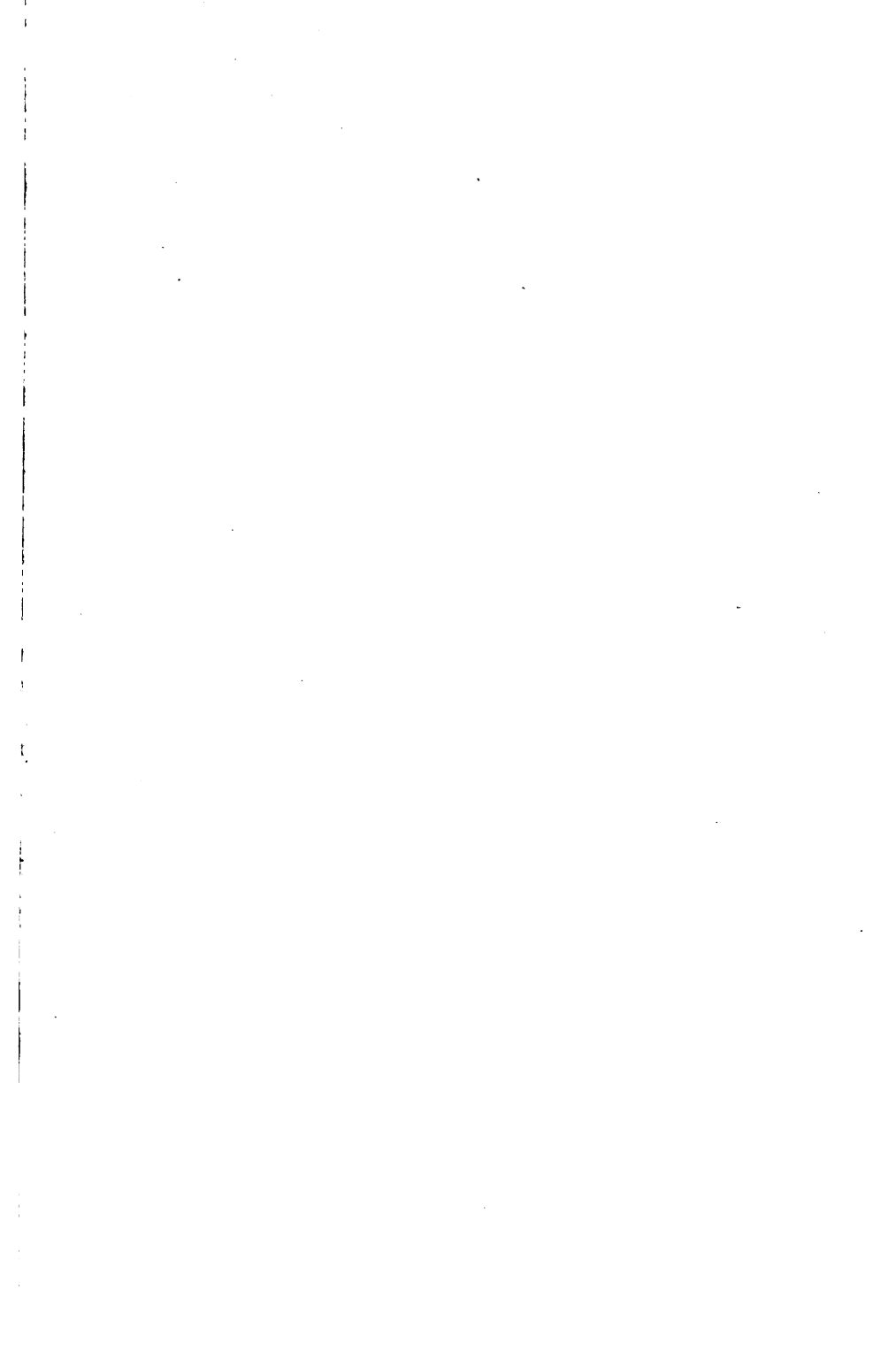
VON NOORDEN

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# DISEASES OF Metabolism and Nutrition

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*Physician-in-Chief to the City Hospital, Frankfurt-on-Main*

Authorized American Edition

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METABOLISM *and* NUTRITION

*By*

PROF. DR. CARL VON NOORDEN

*Physician-in-Chief to the City Hospital, Frankfort a. M.*

AUTHORIZED AMERICAN EDITION  
TRANSLATED UNDER *the* DIRECTION  
*of* BOARDMAN REED, M. D.,  
PROFESSOR *of* DISEASES *of the*  
GASTRO-INTESTINAL TRACT,  
HYGIENE *and* CLIMATOLOGY,  
DEPARTMENT *of* MEDICINE, TEMPLE  
COLLEGE; PHYSICIAN *to the* SAMARI-  
TAN HOSPITAL, PHILADELPHIA, ETC.

PART V

CONCERNING THE EFFECTS OF SALINE WATERS (KISSINGEN,  
HOMBURG) ON METABOLISM

BY

PROF. CARL VON NOORDEN, Frankfort

AND

DR. CARL DAPPER, Bad Kissingen

NEW YORK

E. B. TREAT & COMPANY

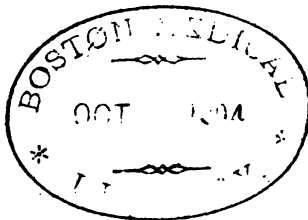
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## AUTHOR'S PREFACE

THIS publication is the second edition of a thesis that Dr. Carl Dapper published eight years ago from my clinic (*Zeitschrift für klin. Med.*, vol. xxx., 1896). The investigations that were published in this first edition were carried out conjointly by Dr. Dapper and myself from 1894 to 1896. Later these studies were continued by both of us according to a definite plan, Dr. Dapper carrying on his investigations on numerous patients who visited his sanitarium in Kissingen, I on the patients of the Municipal Hospital in Frankfort, and my private patients. These later investigations simply corroborate and amplify our original studies.

In view of the great interest that balneological methods of treatment are exciting nowadays, the results of these investigations may herewith be given to a wider circle of readers, in the expectation that they will be a welcome addition to our therapeutic armamentarium.

(Signed) PROFESSOR VON NOORDEN.

FRANKFORT-ON-THE-MAIN,  
*February 20, 1904.*



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## NOTE BY THE AMERICAN EDITOR

PROFESSOR VON NOORDEN has again placed the medical profession under obligations by deciding in an authoritative way the mooted questions concerning the influence of the sodium chloride waters on the digestion in conditions of disturbed gastric secretion as well as in gout, diabetes, and other diseases of nutrition. Applying the satisfactory clinical method of exact observations in a large series of carefully studied cases, he has arrived at results which are different in some respects from those reached by experimenters upon animals and healthy men. His results thus obtained are manifestly a safer guide for clinicians. They constitute an important contribution to the therapeutics of various prevalent as well as rather troublesome affections, and should prove of exceptional interest and practical value. They also refute completely some of the antiquated and unscientific notions which have long been promulgated at the European Spas to the effect that the alkaline and saline waters are incompatible with certain articles of diet, such as the fats, fruit, etc.

Dr. Alfred C. Croftan of Chicago has made the translation into English, as in the case of the previous volumes of this series.

BOARDMAN REED, M. D.

1831 CHESTNUT STREET,  
PHILADELPHIA, *April 20, 1904.*



## THE THERAPY OF THE SALINE WATERS

SOME twelve years ago we undertook a systematic study of the effect of saline mineral waters (that is, mineral waters containing sodium chloride) on different pathological conditions. At the time when these investigations were begun, our only knowledge in regard to the therapeutic effects of these and many other mineral waters was purely empirical. When one desired to know more than the simple fact that this or that mineral water was useful in this or that disease, to know the why and wherefore of the therapeutic effect of the different waters, and to know the influence of the different waters on normal function and on perverted function, it was found that our knowledge was altogether inadequate to answer any of these inquiries. Here and there an animal experiment was reported, from which certain conclusions in regard to the above uncertain points were drawn. Here and there certain clinicians reported experiments on healthy human subjects, but no one up to that time had made any clinical and experimental studies on sick people. This state of affairs was peculiar because, during the years immediately preceding this period, the study of the pathology of metabolism and the therapeutic correction of perverted metabolism had been

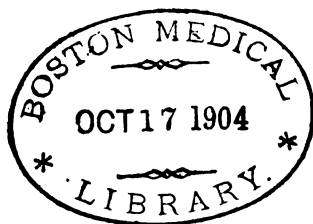


followed with much interest and enthusiasm. It had also been known, ever since the days of antiquity, that mineral waters in particular were capable of exercising an influence upon the metabolism of human beings.

As a matter of fact, many investigations were published in former years in regard to the influence of mineral waters on metabolism. Unfortunately, however, most of the time and labor had been expended in elucidating one point in particular, namely, the effect of these waters on proteid metabolism, and these studies were especially fruitless. Any clinician, however, who sought practical and therapeutic information in the older writings was confronted with nothing but wild hypotheses. We will have occasion to show in the following pages how little positive knowledge had been acquired up to the time when our investigations were begun.

We undertook to amplify our knowledge in this field by a series of clinical and experimental investigations. Particular attention was given to inquiries that commanded practical interest. Such questions were chiefly those that were concerned with the effect of saline waters on digestion and on the arrangement of the diet while a drinking cure was being instituted. The latter investigation in particular seemed desirable, because in many watering places, like Kissingen, Carlsbad, Homburg, etc., dietetic regulations were given to the patients by routine, and these dietetic regulations were justified only by custom. In the light of more

modern scientific studies on the processes of nutrition, these routine dietaries were certainly irrational and could readily jeopardize the reputation of the particular watering-place in which they were customarily prescribed.



## I. CONCERNING THE INFLUENCE OF SALINE MINERAL WATERS ON GASTRIC SECRETIONS

The effect of sodium chloride solutions and natural saline waters on the excretion of hydrochloric acid has repeatedly been made the subject of investigation. Larèche found that the acidity of the gastric contents was reduced in a man suffering from a gastric fistula, if sodium chloride was added to the food. Reichmann obtained the same results in healthy subjects and in patients with dilated stomach in whom he removed the stomach contents by aspiration. Jaworski administered pure water, Carlsbad water (Mühlbrunnen), and Kissingen Rakoczy water, to patients after a period of fasting, and then removed the stomach contents after varying periods of time, and he found that Kissingen saline water was more indifferent, as far as the stimulation of the hydrochloric acid secretion was concerned, than pure water. Schüle performed the most exhaustive and the most exact experiments, and found that small doses of sodium chloride (5 grams added to a test breakfast) exercised no effect upon the excretion of hydrochloric acid. Larger doses (16 grams) produced a considerable reduction in the hydrochloric acid excretion, and if still more was given (24 grams)

the primary decrease of the secretion of hydrochloric acid was followed by a later increase. The propulsion onward of the food into the bowel (motility) was retarded neither by small nor large doses of sodium chloride.

A number of experiments have also been published on the digestion of albumin in the test-tube, with and without the addition of sodium chloride. Besides, a number of animal experiments have been described.

Of the latter, the most important ones are those reported by M. Bönniger, in a dog with a Pawlow gastric fistula, for they were carried out very carefully, and the technique of these experiments was well-nigh perfect. This investigator introduced milk into the stomach of his dogs through a stomach tube, and added 2.25 per cent. of sodium chloride to the liquid. He found that the secretion of gastric juice was considerably reduced, that the acidity of the stomach contents was slightly reduced, and that no effect was exercised upon the digestive power of the gastric secretion. Bönniger unfortunately extended his investigations to only one human subject. He added 4 grams of sodium chloride to a test breakfast, and found that this addition made no changes in the acidity, digestive power, or motor power of the stomach. If he added 7 grams of sodium chloride, however, the acidity of the stomach contents was distinctly reduced.

These experiments, of course, slightly differ from the administration of saline waters that we give for therapeutic purposes, for it makes a great difference

whether we add sodium chloride to the test meal, or whether we order our patients to drink saline waters some time before each meal—the latter, as we know, being the common practice in watering places.

H. Vincent has reported a number of observations in his patients that differ considerably from the results obtained from experimental work. He ordered his patients to eat a constant diet, and on alternate days added much and little sodium chloride to the food. The difference between the salt in the ordinary diet and the salt in the diet to which was added sodium chloride amounted to as much as 12 grams a day. He reported that on a régime containing little sodium chloride gastric hyperchlorhydria developed, and that at the same time the patient suffered from pain in the stomach, and soon began to emaciate. If, on the other hand, the amount of sodium chloride was reduced considerably, the hydrochloric acid secretion was decreased and the body weight increased. Laufer reported similar observations. Personally, we are unable to corroborate the statements made by Vincent, although the results that we have obtained are for the present only preliminary and call for further investigation and elaboration.

It is unnecessary for us to discuss at length other experiments that have been performed in animals and in healthy subjects, for they are all merely an introduction to the clinical experiments that we will discuss. The only true criteria are observations at the bedside, and here we must make the additional postulate that

the experimental investigations correspond as nearly as possible to the practical therapeutic measures that are adopted in actual practice. For just as little as we can determine the therapeutic value of a drug from studying its effect on the healthy subject, so little can we determine the therapeutic value of a mineral water from purely experimental investigations in healthy animals and healthy human beings.

Very little has so far been published in regard to the effect of saline mineral waters on sufferers from gastric diseases. L. Wolff administered 5 grams of sodium chloride in a test meal to a few patients suffering from reduced secretion of hydrochloric acid, but was unable to find any increase in the hydrochloric acid secretion; rather a slight lowering of it. He also found a distinct reduction of the gastric acidity in two patients with average production of hydrochloric acid when he administered small quantities of sodium chloride. In the last two cases, however, the subjective symptoms of the patients improved considerably under the administration of salt. Unfortunately, the number of cases studied by Wolff was very small, and they were, moreover, studied for a very short time only. Very definite statements in regard to the effect of sodium chloride in cases of stomach trouble are reported by Boas. Unfortunately, however, this author does not publish his case protocols. In cases of recent gastritis, with reduced production of hydrochloric acid and increased secretion of mucus, he found that the administration of weak saline waters (Kissingen, Homburg,

Soden, etc.) produced a marked increase in the production of hydrochloric acid, better chymification of the food, and a considerable reduction of the mucus. In older cases the results were less apparent. From these favorable results Boas draws the negative conclusion that saline waters are not suitable for cases of increased hydrochloric acid secretion. He found that this conclusion was corroborated by the practical results he obtained in some cases. In other cases of hyperchlorhydria, again, he found that the patients improved under sodium chloride, without being able to interpret the cause for this improvement.

A number of other authors of note in the field of gastric pathology have published investigations in regard to the effect of sodium chloride on the course of gastric disease, but the material is so scanty that it is hardly worth while to quote from these writers.

A careful study of all the casuistic material that has been published so far shows that there are many discrepancies and disagreements. One fact in particular is striking, namely, that those who worked in the laboratory and who occupied themselves exclusively with physiological investigations invariably reported a decrease in the secretion of hydrochloric acid; whereas, on the other hand, the practicing physicians who reported on the effect of sodium chloride in gastric troubles seem to have given saline waters, particularly in cases in which the secretion of gastric juice was morbidly decreased, and in which they were endeavoring to raise this secretion. Under these circumstances

it seemed a grateful task to undertake a systematic study of the effect of saline waters on the hydrochloric acid excretion in patients suffering from increased and decreased production of hydrochloric acid.

#### INVESTIGATIONS BY THE AUTHORS

In the investigations that we have performed ourselves, we were more interested in studying the effect of the saline waters on the general condition of the patient than on the different digestive processes *per se*. For this reason, we did not undertake to compare the gastric processes on certain days on which sodium chloride was given with the processes on other days on which none of it was given, but we undertook to investigate the problem in a different way, as follows: As soon as the patient came under observation, and before the administration of saline waters was begun, the production of hydrochloric acid was determined. Then Kissingen Rakoczy or Homburg Elizabeth water was administered in the customary way for a certain length of time. At the expiration of a few days a test meal was administered under the same conditions as before, that is, without the simultaneous administration of mineral water, and examined, and such a test was repeated from time to time thereafter. The different patients during this period were instructed to undergo a typical drinking cure, as commonly ordered for the different mineral waters whose effect was being tested.



(a) *Cases of Anacidity and Subacidity of the Gastric Juice*

1. Mr. M. F., aged forty-six years, catarrhus gastricus.

The patient suffers from pressure in the region of the stomach after eating; bloating, belching, and constipation, his troubles dating from an attack of appendicitis twenty years ago. Frequent alcoholic excesses and abuse of tobacco. Recently, considerable increase of his trouble, particularly of the belching and constipation.

March 6, 1895. Aspiration of the stomach contents an hour and a quarter after a test breakfast. The material obtained consisted of mucus that had a neutral reaction. Patient was ordered to drink 300 c. c. of Rakoczy in the morning on an empty stomach.

March 9. One hour after a test breakfast an abundant quantity of bread and mucus was aspirated. Reaction faintly acid. Hydrochloric acid reaction equaled zero. No lactic acid.

March 15. Removal of the stomach contents one hour after breakfast. Hydrochloric acid reaction positive. Total acidity equaled 0.16 per cent.

April 12. Total acidity equaled 0.17 per cent. Hydrochloric acid reaction positive. Patient no longer complains of subjective distress.

2. Karl R. Gastritis chronica following alcoholic excesses.

The patient had been a soldier in the French Foreign

Legion, and had indulged in alcoholic excesses. He had been in the habit of drinking  $\frac{1}{4}$  of a liter of absinthe and 5 liters of wine a day, occasionally as much as  $\frac{3}{4}$  of a liter of absinthe, and 8 liters of wine. He is at present suffering from chronic rheumatism, cirrhosis of the liver, and gastric catarrh.

October 19, 1895. Acidity, 0.13 per cent. No free hydrochloric acid; no free lactic acid.

From now on, daily,  $\frac{3}{10}$  of a liter of Homburg Elizabeth water.

October 22. 0.17 per cent. acidity. Free hydrochloric acid can be demonstrated. No lactic acid.

October 25. 0.16 per cent. acidity. Free hydrochloric acid. No lactic acid.

October 28. 0.15 per cent. acidity. Free hydrochloric acid. No lactic acid.

3. Lorenz Sch., aged twenty years; acute gastritis.

The patient is neuropathic, and has been suffering for some days from vomiting and diarrhea following the use of unripe fruit. In addition he is afflicted with great irregularity of the pulse and hyperæsthesia of the pharynx.

September 7, 1895. Acidity, 0.09 per cent. No free hydrochloric acid. From now on daily  $\frac{3}{10}$  of a liter of Homburg water.

September 10. Acidity, 0.19 per cent. No free hydrochloric acid.

September 13. Acidity, 0.23 per cent. Free hydrochloric acid. No more vomiting. Normal bowel action.

4. Bünt, aged forty-six; gastritis following alcoholic excesses. Incipient pulmonary phthisis.

Was perfectly healthy until about three weeks ago. At that time loss of appetite, frequent vomiting, particularly after eating sweet or fat articles of food, the vomiting occurring immediately after eating. For a number of days recently vomiting of mucous, bile-stained masses in the morning before breakfast. Has been in the habit of drinking fifteen glasses of beer a day, with a liter of cider and five or six glasses of whisky.

The liver moderately enlarged; the urine free from albumin; the stomach not dilated. The gastric contents was tested with an Ewald test breakfast on December 17. Total acidity, 0.06 per cent. Hydrochloric acid deficit, 0.03 per cent. No lactic acid.

The patient received 600 c. c. of Rakoczy daily.

December 19. Acidity, 0.11 per cent. Hydrochloric acid deficit, 0.01 per cent.

December 29. Acidity, 0.06 per cent. Of this due to free hydrochloric acid, according to Mintz, 0.01 per cent.

January 3. Acidity, 0.11 per cent. Of this due to free hydrochloric acid, according to Mintz, 0.04 per cent.

As soon as the patient began to drink Rakoczy water he ceased vomiting. The appetite improved, and the size of the liver was reduced considerably.

5. F. R., aged fifty-four; gastritis following alcoholic excesses; chronic alcoholism.

Patient had previously been healthy; came to the hospital on account of swelling of the feet. Complained of poor appetite; had been in the habit of drinking ten glasses of beer and  $\frac{3}{4}$  of a liter of whisky a day.

Liver and spleen not enlarged. Urine contains a moderate amount of albumin. There is a tremor of the hands.

The gastric contents after a test breakfast was as follows:

On January 7, total acidity, 0.14 per cent. Of this, due to free hydrochloric acid, according to Mintz, 0.03 per cent.

On January 8, total acidity, 0.13 per cent. Of this, due to free hydrochloric acid, according to Mintz, 0.03 per cent.

Patient is ordered to drink 600 c. c. of Rakoczy every day on an empty stomach.

On January 11, total acidity, 0.20 per cent. Of this, due to free hydrochloric acid, according to Mintz, 0.01 per cent.

On January 14, total acidity, 0.26 per cent. Of this due to free hydrochloric acid, according to Mintz, 0.14 per cent.

The appetite is restored; patient has gained 2.4 kilos in eight days.

6. C. R., aged 60 years; subacute gastritis.

Complains of a feeling of pressure in the gastric region after eating. This has persisted for five days. The appetite is poor; has been in the habit of drinking

from three to four glasses of beer and twelve pfennigs' worth of schnapps a day.

The liver is not enlarged; the urine contains a moderate amount of albumin; there is a tremor of the hands.

Examination of the gastric contents with Ewald's test breakfast.

On January 6, 1896, total acidity, 0.08 per cent. Free hydrochloric acid, zero; lactic acid, zero.

The patient is ordered to drink 600 c. c. of Rakoczy every day on an empty stomach.

On January 11, 1896, total acidity, 0.19 per cent. Free hydrochloric acid, according to Mintz, 0.07 per cent.

The appetite is restored, the urine is free from albumin, and the patient by his own request is dismissed.

7. J. H., aged 32 years; gastritis following alcoholic excesses; cirrhosis of the liver.

The patient was never sick before. Had been in the habit for the last few years of drinking from ten to twenty glasses of beer a day and from twenty to twenty-eight pfennigs' worth of schnapps. Complains of loss of appetite.

The stomach is not enlarged, nor sensitive to pressure. The liver is hard, enlarged, and sensitive to pressure. Arterio-sclerosis.

Examination of gastric contents with an Ewald's test breakfast gives the following results:

On December 22, total acidity, 0.12 per cent. Free

hydrochloric acid, zero; lactic acid, zero. The patient is ordered to drink 400 c. c. of Rakoczy a day.

December 28. Total acidity, 0.21 per cent. Free hydrochloric acid, according to Mintz, 0.08 per cent.

December 30. Total acidity, 0.19 per cent. Free hydrochloric acid, according to Mintz, 0.02 per cent.

January 3, 1896. Total acidity, 0.19 per cent. Free hydrochloric acid, according to Mintz, 0.02 per cent.

January 8. Total acidity, 0.19 per cent. Free hydrochloric acid, according to Mintz, 0.07 per cent.

The appetite is restored; the liver is decreased in size by at least two cm., and is less sensitive to pressure than before.

In addition to the cases reported above, numerous other cases of acute and chronic gastritis have been reported in the meantime, in which the condition of subacidity that existed in the beginning disappeared under the prolonged use of saline mineral waters (Kissingen and Homburg), while at the same time the digestive disturbances of the patient also improved. The results were particularly favorable in those forms of gastric catarrh that followed alcoholic excesses and the immoderate use of tobacco. Equally favorable results were obtained in a few cases of phthisis and in patients suffering from icterus due to biliary stasis. In all of these disorders it has been known empirically for some time that saline waters are a proper remedy.

Whereas many of the results were exceedingly favorable, we must not conceal the fact that occasionally bad results or no results at all were obtained.

Cases of anacidity and subacidity that were of nervous origin proved to be particularly obstinate. The subjective disturbances of the patients, it is true, seemed to improve under the continued use of saline mineral waters, and it was often possible to increase the weight of the patients considerably when sufficient nourishment was administered, but in no case was an increase of the acidity obtained. The same negative result was obtained in a number of cases of phthisis with fever. All that we succeeded in doing in such cases was to improve the appetite by the use of saline waters, but we did not succeed in increasing the production of hydrochloric acid. Nevertheless, the increase of the appetite itself had to be considered a therapeutic result of some value. In a few cases of phthisis the hydrochloric acid secretion improved together with the appetite.

The following case cannot be included in the above category, for in this patient all the symptoms improved with Homburg water, while at the same time hyperacidity developed; as this hyperacidity had not existed before, the excessive secretion of hydrochloric acid became an indication for interrupting the use of the mineral water.

8. Mr. L. H., aged thirty-two years; nervous dyspepsia.

Ten years ago tuberculosis of the apices of the lungs. Recovery. In 1887 the patient developed frequent gastric disturbances and intolerance for alcohol. Severe "after-jag" (Katzenjammer), with vomiting of bile, even after a slight alcoholic excess. Much

nausea, pain on pressure, and spasmodic contractions in the region of the stomach. Recently the symptoms have become aggravated after a period of relative improvement.

Dilatation of the stomach cannot be determined positively, but a very large quantity of stomach contents can be aspirated through the stomach pump. The amount of stomach contents is larger after a test breakfast than the test breakfast itself.

July 20, 1895. Acidity, 0.19 per cent.; hydrochloric acid reaction negative; no lactic acid. The patient is ordered to take 400 c. c. of Homburg Elizabeth water in the morning.

On July 30, 1895, acidity, 0.22 per cent.; hydrochloric acid reaction positive.

On August 9, 1895, acidity, 0.31 per cent.; hydrochloric acid reaction very positive.

The patient's symptoms are very much less severe. In view of the increase in the hydrochloric acid secretion, the use of Homburg water was stopped, and the patient was treated by dietetic regulations thereafter.

#### *(b) Cases with Hyperacidity of the Gastric Juice*

In the beginning we employed saline waters with considerable hesitancy when treating cases of hyperacidity of the gastric juice, because it had been variously stated by different writers on the subject that such patients did not stand saline waters very well. To judge from our experience in this class of cases, the



disagreeable effects of saline waters have been greatly exaggerated; in fact, we feel justified in stating most positively that numerous cases of hyperacidity are rapidly and permanently benefited by the use of saline mineral waters. We have records to-day of over a hundred cases in which the most favorable results imaginable were obtained. We report a few cases that were observed some years ago, and also give a tabulated summary of the cases observed within the last few years. Twenty-five cases that were carefully observed have in addition been reported by one of us (Dapper) before the Congress of Internal Medicine in Carlsbad, in 1899.

1. Mr. J. K., aged twenty-three years; nervous dyspepsia with hyperacidity and hypersecretion. Gastric atony.

A very nervous young man with a neuropathic disposition. A sufferer from habitual constipation; hyperæsthesia of the stomach; much acid belching after eating, and within the last few months considerable emaciation.

Physical examination revealed impaired motility of the stomach; hypersecretion and hyperacidity of the gastric juice. After a test breakfast, consisting of a quarter of a liter of tea and one roll, about 400 c. c. of fluid of an acidity of 0.03 per cent. (calculated for hydrochloric acid), were aspirated from the stomach. No dilatation of the stomach.

The treatment consisted in the administration of Kissingen Rakoczy water, in doses of 300 to 400 c. c.; in addition, frequent lavage of the stomach. The diet

consisted of large amounts of food, containing much fat finely distributed. At times extract of belladonna was also administered.

At the expiration of two months the patient had gained ten pounds; after four months twenty pounds. At the end of the fourth week the subjective symptoms were essentially relieved. An after-cure in Kissingen, lasting about four weeks, did away with the last remnant of the patient's distress and restored him to complete and permanent health.

The analyses of the stomach contents gave the following results:

February 2, 1895. Total acidity, 0.03 per cent. Hydrochloric acid reaction very strong; no lactic acid.

From this time on Kissingen Rakoczy water was given. On the days on which the gastric contents was aspirated no Rakoczy was given, or it was given after the lavage had been performed.

Feb. 4,	1895.	Total acidity,	0.28	per cent.	} Hydrochloric acid reaction strong; no lactic acid.
" 6,	"	" "	0.30	"	
" 11,	"	" "	0.22	"	
" 21,	"	" "	0.15	"	} Hydrochloric acid reaction negative; no lactic acid.
March 1,	"	" "	0.12	"	
" 4,	"	" "	0.12	"	

The use of Kissingen water was stopped.

March 12, 1895. Total acidity, 0.16 per cent.

March 12,	1895.	Total acidity,	0.16	per cent.	} Hydrochloric acid reaction negative.
" 15,	"	" "	0.16	"	

March 27, 1895.	Total acidity, 0.18 per cent.	} Hydrochloric acid reactions positive, no lactic acid. No more gastric disturbances.
April 22, " "	" " 0.19 "	
May 7, " "	" " 0.18 "	} 300 c. c. of Rakoczy. Hydrochloric acid reaction positive; no more gastric disturbances.
" 14, " "	" " 0.16 "	
" 21, " "	" " 0.18 "	

2. Mr. R., assessor, aged thirty-two years. Nervous dyspepsia with hyperacidity.

Patient had weak nerves as a child. He led a very strenuous intellectual life, and had been very nervous since his fifth year. Usually constipated. Complains of much heartburn. Is emaciated.

The physical examination shows that the gastric contents is propelled onward within the normal time limit. Hyperacidity of the gastric juice. After a test breakfast, total acidity, 0.34 per cent. (May 30, 1895); strong acid reaction. The patient receives 300 to 500 c. c. of Kissingen Rakoczy water, a very copious diet, and carbonated mud baths.

At the end of two weeks considerable improvement. At the end of four weeks and a half no more subjective symptoms. According to a written communication transmitted by the patient, the recovery was permanent. Patient gained fourteen pounds.

The examination of the stomach contents gave the following results:

May 30, 1895.	Total acidity, 0.34 per cent.	} Hydrochloric acid reactions positive; no lactic acid.
June 7, " "	" " 0.28 "	
" 14, " "	" " 0.21 "	
" 21, " "	" " 0.18 "	
" 24, " "	" " 0.16 "	

### 3. Mr. C. H., aged forty years; hyperacid dyspepsia.

Patient is a nervous man who is overworked in his business. He travels very much, and takes his food very irregularly. Smokes a great deal (ten to twelve cigars). For about three months patient has been complaining of much belching, occasional vomiting, heartburn, and constipation. The stomach is not dilated. On May 16, 1895, aspiration of the stomach contents after a test breakfast. Total acidity, 0.28 per cent.; no lactic acid. The patient is ordered to take 200 c. c. of Homburg Elizabeth water in the morning. Tobacco is interdicted; the patient is instructed to eat at regular intervals; the stomach is frequently washed out.

May 21, 1895.	Total acidity, 0.22 per cent.	} Hydrochloric acid reactions positive.
" 27, " "	" " 0.21 "	
June 21, " "	" " 0.18 "	

The use of Homburg water was gradually stopped. All the symptoms had disappeared by the beginning of July.

### 4. Mr. St., aged thirty-two years; nervous dyspepsia with hyperacidity; atony of the intestinal tract.

A nervous individual; very actively engaged on the stock exchange. Irregularity in eating; has been suffering for two years from gastric disturbance, with much heartburn and occasional vomiting, the vomiting

being preceded by pain in the stomach; constipation; emaciation.

Examination revealed impaired motility of the stomach wall; hyperacidity of the gastric juice (June 2, 1895); no dilatation of the stomach.

Treatment: 300 to 500 c. c. of Kissingen Rakoczy and abundant diet containing much fat, and given at frequent intervals throughout the day. Carbonated mud baths; faradic current.

Examination of the stomach contents after a test meal gave the following results:

June 2, 1895.	Total acidity,	0.31	per cent.	} Strong hydrochloric acid reaction; no lactic acid.
" 9, "	" "	0.24	"	
" 14, "	" "	0.21	"	
" 21, "	" "	0.19	"	
" 28, "	" "	0.18	"	

At the end of two weeks the symptoms had disappeared; the bowel action was regular. (Patient gained fourteen pounds and was permanently restored to health.)

5. Mr. C., aged sixty-six years; hyperacid dyspepsia. Has been a sufferer for many years from gastric disturbances. Has traveled much since his twentieth year. Irregularity in eating. Formerly smoked very much. For three years has complained of gastric pain, particularly during the night, improved somewhat after eating. Emaciation. Acid belching, and within the last few weeks frequent vomiting.

Examination revealed that the stomach got rid of its contents within a normal time. Hyperacidity; no dilatation of the stomach (June 17, 1895).

The treatment consisted in the administration of 300 c. c. of Rakoczy; the frequent administration of large quantities of food; carbonated mud baths.

The analyses of the stomach contents after a test breakfast showed:

June 17, 1895.	Total acidity, 0.34 per cent.	} Strong hydrochloric acid reactions; no lactic acid.
" 24, "	" " 0.28 "	
" 29, "	" " 0.24 "	
July 4, "	" " 0.22 "	
" 14, "	" " 0.20 "	

The patient writes that he is free from all distress.

6. Mr. J. M., aged forty-nine years; hyperacid dyspepsia.

Has been suffering from a "weak stomach" since his youth. Frequently constipated. Belching, heart-burn, especially if patient works hard. For two months has been complaining of frequent pain in the stomach, and has lost weight during this period. A very nervous, mentally overworked man.

July 23. Aspiration of the stomach contents after a test breakfast. Total acidity, 0.34 per cent.; strong hydrochloric acid reaction.

Treatment: Regulation of the diet; large quantities of butter, 100 to 120 grams *pro die*. Homburg Elizabeth water, 300 c. c.

August 8. Total acidity, 0.20 per cent.; subjective symptoms considerably improved; continuation of the cure at home.

August 27. The symptoms have disappeared.

7. Miss Veronica Kr., aged twenty-four years; chronic nephritis with hyperacidity of the stomach.

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Patient comes under observation suffering from uræmic convulsions. Urine contains much albumin; the general health improves in the course of a few days. The patient, however, continues to complain of pain in the stomach. Patient is awakened frequently during the night by gastric pain. The stomach is not enlarged. Analysis of the gastric contents after an Ewald test breakfast shows the following:

On December 12. Total acidity, 0.03 per cent. Strong hydrochloric acid reaction.

On December 13. Total acidity, 0.25 per cent. Strong hydrochloric acid reaction.

The patient is ordered to take 600 c. c. of Rakoczy every day on an empty stomach.

December 26. Total acidity, 0.35 per cent. Of this free hydrochloric acid, according to Mintz, 0.21 per cent.

January 4, 1896. Total acidity, 0.35 per cent. Of this free hydrochloric acid, according to Mintz, 0.21 per cent.; 400 c. c. of Rakoczy water are taken for three days more, and then the administration of the water is stopped.

January 10, 1896. Total acidity, 0.22 per cent. Of this free hydrochloric acid, according to Mintz, 0.11 per cent.

January 14, 1896. Total acidity, 0.20 per cent. Of this free hydrochloric acid, according to Mintz, 0.08 per cent.

The gastric disturbances improved from the 4th of January, and disappeared completely after the 10th of

January. It is probable that this patient was suffering from a gastric ulcer.

In this case large quantities of Rakoczy water (600 to 800 c. c.) exercised no distinct influence on the excessive hydrochloric acid secretion in the beginning. As soon as the daily quantities of the mineral water were reduced, the excessive hydrochloric acid production was also reduced and remained approximately normal.

TABULATED SUMMARY

Name and age	Date of the stomach analysis	Per cent. acidity calculated for HCl.	Free HCl. according to Minitz.	Rakoczy	Gain in weight	Remarks
Mr. v. A. 36 years.	May 14, 1899.	0.32	0.21	300-400	15	Nervous dyspepsia with hyperchlorhydria, and delayed emptying.
	" 24, "	0.28	0.17	c. c.	in 4	
	June 3, " " 13, "	0.24 0.20	0.11 0.09	pro die.	weeks.	
Mr. S. A. 26 years.	June 27, 1899.	0.35	....	400 c. c.	18	Acid catarrh of the stomach. A tony with impaired motility.
	July 6, "	0.30	....	pro die.	in 5	
	" 16, " Aug. 1, "	0.24 0.19	.... ....	.... ....	weeks.	
Countess W. 31 years.	Aug. 3, 1899.	0.30	....	350-400	20	Nervous dyspepsia; hyperchlorhydria; enteroptosis; floating kidney on right side.
	" 13, "	0.25	....	c. c.	pounds	
	" 22, " Sept. 8 "	0.21 0.17	.... ....	pro die.	in 5½ weeks.	
Mr. Sb., 25 years.	Sept. 2, 1899.	0.34	0.23	400-450	17	Acid gastric catarrh. A tony
	" 12, "	0.28	0.17	c. c.	pounds	
	" 22, " Oct. 4, "	0.22 0.19	0.12 0.10	pro die.	in about 5 weeks.	
Mr. K. 39 years.	May 2, 1900.	0.36	0.24	350-400	18	Nervous dyspepsia; hyperchlorhydria; nicotinitism.
	" 17, "	0.27	0.15	c. c.	pounds	
	" 29, " June 8, "	0.21 0.18	0.10 0.08	pro die.	in 5 weeks.	
Mr. R. 53 years.	June 17, 1900.	0.34	....	300-450	16	A tony; impaired motility of the stomach; acid gastric catarrh.
	" 30, "	0.25	....	c. c.	pounds	
	July 16, "	0.19	....	pro die.	in 4 weeks.	
Miss v. B. 24 years.	July 2, 1900.	0.30	....	300-400	20	Nervous dyspepsia with hyperchlorhydria. No ulcer.
	" 16, "	0.23	....	c. c.	pounds	
	Aug. 1, " " 10, "	0.21 0.17	.... ....	pro die.	in 5½ weeks.	
Mr. Rob. K. 26 years;	Sept. 1, 1900.	0.35	0.24	400 c. c.	17½	Nervous dyspepsia with hyperchlorhydria; nicotine and alcohol.
	" 14, "	0.35	0.14	pro die.	pounds	
	" 28, " Oct. 8, "	0.21 0.18	0.11 0.07	.... ....	in 5 weeks.	



## TABULATED SUMMARY—Continued

Name and age	Date of the stomach analysis	Per cent. acidity calculated for HCl.	Free HCl. according to Mintz.	Rakoczy	Gain in weight	REMARKS
Lieutenant v. O. 27 years.	May 10, 1901.	0.34	....	300-400	15	Atony; acid catarrh of the stomach.
	" 26, "	0.24	....	c. c.	pounds	
	June 9, "	0.19	....	pro die.	in 4 weeks.	
Dr. F. 35 years.	June 15, 1901.	0.35	0.23	350-400	22½	Nervous dyspepsia.
	" 25, "	0.27	0.16	c. c.	pounds	
	July 5, "	0.21	0.10	pro die.	in 5½ weeks.	
Baroness v. O. 32 years.	" 14, "	0.24	0.11			Nervous dyspepsia; hyperchlorhydria.
	" 25, "	0.18	0.08			
	Aug. 10, 1901.	0.31	0.19	300-400	21	
Mr. S. A. 27 years.	" 24, "	0.23	0.11	c. c.	pounds	Impaired motility; acid catarrh of the stomach.
	Sept. 7, "	0.19	0.10	Rakoczy.	in 5½ weeks.	
	" 18, "	0.16	0.08			
Mr. L. 43 years.	May 20, 1902.	0.36	0.24	350-450	15½	Nervous dyspepsia with hyperacidity.
	June 5, "	0.24	0.12	c. c.	pounds	
	" 19, "	0.18	0.09	Rakoczy.	in 4 weeks.	
Miss v. R. 23 years.	June 16, 1902.	0.33	....	300-350	18	Nervous dyspepsia.
	" 26, "	0.28	....	c. c.	pounds	
	July 10, "	0.21	....	Rakoczy.	in 4½ weeks.	
Countess W. 31 years.	" 20, "	0.17	...	zy.		Nervous dyspepsia with hyperacidity; enteroptosis and floating kidney
	Sept. 3, 1902.	0.29	0.18	300-350	16½	
	" 15, "	0.24	0.12	c. c.	pounds	
Mr. Str. 26 years.	" 21, "	0.21	0.10	Rakoczy.	in 5 weeks.	Nervous dyspepsia with hyperchlorhydria
	May 9, 1902.	0.31	....	350-400		
	" 23, "	0.23	....	c. c. Rakoczy.	....	
Mr. Th. R. 31 years.	June 10, "	0.18	....	koczy.		Acid gastric catarrh and atony.
	June 15, 1903.	0.32	0.22	400 c. c.	19	
	" 27, "	0.27	0.13	pro die.	pounds	
Mr. Th. R. 31 years.	July 8, "	0.21	0.10		in 5 weeks.	Acid gastric catarrh and atony.
	" 20, "	0.16	0.07			
	Aug. 20, 1903.	0.35	0.23	350-400	22	
Mr. Th. R. 31 years.	Sept. 3, "	0.26	0.13	c. c.	pounds	Acid gastric catarrh and atony.
	" 17, "	0.20	0.10	pro die.	in 5½ weeks.	
	" 17, "	0.17	0.08			

Whereas the above cases all showed good effects from the use of saline waters, there were, on the other hand, a number of cases in which the treatment was not successful. The latter, however, constitute the minority. It is impossible for the present to judge definitely which cases are suitable for treatment with

saline mineral waters and which are not. While it is not, therefore, possible to say with absolute certainty that this, that, or the other case is a suitable one for this treatment, still certain predictions can be made, as follows :

Uniformly favorable results are almost invariably obtained in cases of hyperacidity occurring in nervous individuals ; also in hyperacidity occurring in cases of acid catarrh of the stomach and atony of the stomach. Especially favorable and rapid results are obtained in those cases of dyspepsia that occur in persons who have overexerted themselves mentally. Whenever the patients were instructed to eat abundantly, and especially to eat large quantities of fat, in addition to taking the saline mineral waters, the therapeutic results were so good that they could be considered brilliant ; for in all of these cases the gastric disturbances were cured, and, in addition, the patients gained in weight and in strength. The only cases in which the results were absolutely unfavorable were in young girls suffering from anæmia and chlorosis. In such patients we occasionally witnessed an increase of the gastric disturbances, increased formation of acid (an increase of the hyperacidity that originally existed before the treatment was begun), with loss of appetite, so that we ultimately decided to stop further therapeutic experiments with saline waters in such patients.

We, therefore, can chronicle the remarkable results that one and the same method of balneological treatment acts curatively in different diseased states of the

stomach, and that at the same time this treatment may produce diametrically opposite results in regard to the chief symptom of all these diseased states, namely, the increased production of acid. This teaches us that the curative effect of the saline mineral waters cannot be gauged according to a simple formula. We are forced to abandon such routine statements as that sodium chloride increases or decreases the hydrochloric acid of the stomach, and we must be particularly careful not to measure our therapeutic indications according to such formulas. Otherwise, one incurs the danger of depriving the patients of a very useful treatment for the sake of living up to the postulates of such a formula. It is very possible that in a healthy subject the effect of saline mineral waters is exercised only in one direction, namely, towards decreasing the hydrochloric acid of the stomach. When the stomach is sick, however, this reaction cannot be considered to be so simple, for here apparently certain factors become operative that are altogether independent of the secretion of hydrochloric acid, and these unknown factors precisely produce the excellent therapeutic result that is obtained both in cases of subacidity and of hyperacidity.

We do not by any means claim that the use of the saline mineral waters alone can be made responsible for the good therapeutic results obtained in the class of cases described above. We need hardly mention that in all of the patients very exact and carefully determined dietetic measures were employed, together with the saline waters, and that the regimen was dif-

ferent in each case, and was adapted to the requirements of each individual patient. Without such dietetic prescriptions it would have been altogether impossible to obtain good results in many of the cases. On the other hand, the good results would not have been obtained if the ordinary dietetic scheme had been followed that is adopted as a routine measure in many of the watering places, and that is characterized chiefly by the exclusion from the diet of certain articles of food. For instance, if we had followed the scheme that is so popular in many watering places, of excluding all fat from the diet of these patients (see below) instead of permitting them to eat from 150 to 200 grams of butter every day, our emaciated patients, with nervous dyspepsia and hyperacidity, might possibly have been relieved of their stomach symptoms, but they would certainly have lost much strength and weight. We do not think that von Sohlern is justified in stating, as he does in a small monograph that has recently appeared, that the favorable results claimed from the use of saline mineral waters in the treatment of hyperacidity are due exclusively to the dietetic and hygienic regulations employed simultaneously in these cases, and not at all to any specific effect of the saline waters. One might just as well make the same statement in regard to cases of chronic catarrh of the stomach due to alcoholic excesses; and in this condition no one will certainly deny that the use of saline mineral waters has been a very successful treatment for a great many years. This point was made by Dapper in a paper that

he read before the International Medical Congress in Carlsbad; and, nevertheless, no one will gainsay that even in alcoholic gastritis the use of saline mineral waters alone would certainly never lead to the goal if all other measures that are commonly used in the treatment of stomach disease were neglected. In all of these cures the prescription of the saline water is only one link in the long chain of rules and regulations that are given to the patient, but the water is a very strong link in this chain, and one that is of paramount importance.

## II. ON THE EFFECT OF SALINE MINERAL WATERS ON THE ABSORPTION OF FOOD, AND PARTICULARLY ON THE DIGESTION OF FATS

WE must now approach a question that is of the greatest practical interest. In numerous watering places in which diseases of the digestive apparatus, diseases of metabolism and of nutrition are treated, a routine scheme of diet-prescribing has been adopted. Instead of inquiring at once what particular diet is the most appropriate one for each individual case, or each particular disease, the water of the watering place is considered primarily, and the first question that the patient asks the physician is, What can I eat while I am drinking this particular water, and what can't I eat? The reason why all the patients who frequent these watering places invariably ask this question is that the physicians who practice in such places have educated the lay public for decades to look upon the matter in this light. I refer in particular to Carlsbad, Homburg, and Kissingen. Whereas undoubtedly a limited number of intelligent and careful physicians have always been practicing in these places, physicians who have learned to emancipate themselves from the rigid dogma of a definite dietetic scheme said to be suited to

the particular water cure that was instituted, such practitioners, I am sorry to say, have always been the exception, and the practitioners in general have always been in the habit of prescribing a diet according to a fixed scheme. Not very long ago (*Therapeut. Monatsh.*, 1887, No. 1) such a scheme was published by an eminent authority, in which the "dietetic régime to be adopted when employing a Carlsbad cure" was described, without any regard whatsoever to the disease or to the individual undergoing the treatment. In this paper the different articles of food and drink were arranged in a very one-sided way, according to the following categories, namely: Articles to be completely avoided; articles to be used in moderation; articles to be permitted. In nearly all of the pamphlets that are published in such watering places as Kissingen, Homburg, etc., and that are intended to advertise these particular waters, such dietetic schemes are given, and invariably the saline water is considered in the first place, and the disease and the patient in the second. In addition, there is a popular prejudice among many physicians, hotel-keepers, and the general public, to the effect that each particular saline water calls for the exclusion of certain definite articles of food from the diet, regardless of the disease. In other words, that each water calls for a definite diet. This prejudice is so deeply rooted that any physician who departs from this routine scheme is severely criticised and is accused of experimenting in a dangerous way with the well-being of his patients; in fact, the prescription of a dietary that

deviates from the routine régime is discussed as a sensational event of the day.

Fats, in particular, seem to figure prominently among the articles to be avoided. Thus the Carlsbad scheme of diet that has been mentioned above, includes the fats above all among the "forbidden" articles of food. In some of the watering places the directors of the cure have placarded the trees in the park with notices forbidding the use of fats, and still others print this prohibition on the labels of the bottles that they send away. And all this, I am sure, can only occur with the consent of the physicians practicing in the different watering places. How did this peculiar prohibition originate? We hardly think it worth while to incur the trouble of searching the literature for the original articles in which the use of fat is condemned.

There can be no doubt that many patients who go to these watering places should not eat fat, or who at least should reduce the quantity of fat ingested. This may very well be due to the character of the disease from which they are suffering. We refer, for instance, to cases of obesity, and to many patients suffering from certain gastric and intestinal diseases (not all, by any means), and from jaundice. Many of the patients, however, who go to Carlsbad, Kissingen, Homburg, etc., and who are not suffering from any of the above conditions, should by no means be deprived of the valuable fats of the normal diet, for if they are, it is impossible to maintain their general nutrition and strength, and certainly impossible to improve their gen-



eral condition. Nevertheless many physicians forbid fat to these people for the sake of a fairy tale that is devoutly believed at these watering places. We believe that a conscientious and honest physician would have to send many sufferers from gastric and intestinal trouble, many patients with diabetes and gout, many neurasthenics and convalescents from various diseases, away from these watering places if the legend that there is an antagonism between the water and fat were true.

But possibly this is no legend at all, but the truth. In order to determine this point, two methods could be pursued, namely, in the first place, simple observation of the patients; in the second, experimental investigation. As far as the former method is concerned, we must content ourselves with the statement that we personally have deviated from the old-established rule prevalent in these watering places in numerous patients, and that we have never witnessed any unfavorable effects from the simultaneous administration of large quantities of fat, and of Kissingen or Homburg water. To hundreds of patients who visited these watering places, Dapper, in Kissingen, and von Noorden, in Homburg, have given large quantities of fat together with the water, and have succeeded in increasing the weight of these patients and in producing a cure of the primary disease that they were suffering from. The results obtained from this practice were sufficiently favorable to satisfy the most exacting demands.

Nevertheless, it appeared desirable to know some-

thing definite in regard to gastric digestion when saline waters and a diet containing much fat were simultaneously administered. For this purpose, von Noorden some time ago performed some comparative experiments in three patients. All three were suffering from hyperacidity with mild gastric atony. Their breakfast consisted of 50 grams of roll with 50 grams of butter, and, in addition, 200 c. c. of tea, 100 c. c. of thick sterilized cream, containing 30 per cent. of fat. Each patient, therefore, at each test breakfast, received about 50 grams of fat. Each patient's stomach contents were aspirated four times: twice after the administration, one hour before the breakfast of 300 c. c. of Homburg Elizabeth water; twice without previous administration of any of the water. The stomach contents in each case were removed exactly one hour after the patient began to eat the test breakfast.

i. Mr. von K.

*a.* (Without water.) The stomach contents very small, containing distinct remnants of bread; a thick layer of fat forms at the top of the aspirated material. Acidity, 0.33 per cent. Free hydrochloric acid, 0.20 per cent.

*b.* (With water.) The stomach found completely empty.

*c.* (Without water.) The result of the examination of the stomach contents the same as in *a.* Acidity, 0.31 per cent. Hydrochloric acid reaction was strong; free hydrochloric acid not determined quantitatively.

b. (With water.) The stomach found completely empty.

In the second and third cases the stomach was found completely empty after *each* aspiration performed one hour after the test breakfast. These two observations teach us, at least, that the use of the saline mineral waters does not impair gastric digestion, despite the administration at the same time of abundant quantities of fat, and that the simultaneous administration of water and fat at all events does not interfere with the normal propulsion onward of the food from the stomach. In the first case it could even be positively demonstrated that the motility of the stomach was improved by the administration of mineral water before the test breakfast.

The second method by which we can determine the effect of eating fat together with a saline drinking cure is to study fat digestion experimentally. In this way it can be definitely determined whether the eating of fat is harmful or not. We considered it the proper method to subject the total digestive powers of the whole digestive tract to examination, that is, to examine the *fæces* while at the same time taking into consideration the composition of the diet. In case such determinations of the assimilative powers of the digestive tract of these patients are coupled with a study of the general health of the individual, they are certainly of decided value. If one should find, for instance, that the absorption of fat proceeds in a faultless manner, while at the same time the patient

suffers no distress and enjoys general well-being, then no one can be justified in advancing any further objections to the administration of fat together with saline waters.

Older metabolic experiments performed many years ago in patients who were drinking saline or bitter waters yield very little information that can be utilized to elucidate the above inquiry. This is due to the fact that no quantitative determinations of the constituents of the fæces were ever undertaken, that the nitrogen of the fæces was never determined, and above all that no fat analyses of the stools were made. The earliest determination that we can utilize at all was performed by von Noorden. We communicate the main results of this study in this place in brief outline.

The patient was a woman of fifty years, suffering from an advanced degree of habitual constipation. From April 15 to 17, 1890, she was given a diet that consisted of white bread, scraped meat, milk, butter, and salt. Each day she received 77 grams of fat (according to a careful analysis of the food). In addition she drank every morning 350 c. c. of Hunyadi water on an empty stomach. Her general health remained unimpaired, while the evacuation of the bowels proceeded with greater facility, although there was still some constipation. The fæces contained 2.98 grams of fat a day, corresponding to 3.87 per cent. of the ingested fat. The absorption of fat was consequently excellent. It may be well to mention in this place that the results of this experiment first induced

us to carry on our investigations further. The experiment that we have just recorded is of particular importance, because it was carried out in a patient suffering from a condition in which saline laxatives are frequently administered for therapeutic purposes.

Later another metabolic experiment that we can utilize for our purposes was published by J. Katz, the experiment being instigated by von Noorden. In view of the scanty material that is at our disposal in this field, this investigation is of considerable value, even though it was performed in a healthy individual (viz., on the investigator himself). We are fully aware of the fact that it is a precarious matter to apply the results obtained in a healthy individual to a sick individual, and to transfer conclusions from the reaction of the healthy body to the reaction of the diseased body.

The analyses in this very exact series of investigations were performed in the laboratory of N. Zuntz, under the personal supervision of this investigator. The task set was to study the effect of Harzburg Crodo water on metabolic processes. This water contains 14.9 grams of sodium chloride to the liter. The other ingredients in this water are insignificant in quantity as compared to its content of sodium chloride. The daily diet (meat, white bread, rice, butter, milk, beer, sugar, salt, tea) contained: 17.14 grams of N.; 125 grams of fat; 311 grams carbohydrates.

	Loss in the fæces ( <i>pro die</i> ) in grams		Loss in the fæces in per cent. of ingesta	
	N.	Fat	N.	Fat
First fore-period (5 days) . . . .	0.76	2.03	4.0	1.8
Second period with saline, . . . .	1.01		5.8	1.8
1 day, 420 grams; . . . .				
4 days, 1050 grams ( <i>pro die</i> ); . . . .		2.2		
Third after-period (3 days) . . . .	1.02	2.1	5.5	1.7

It will be seen from this table that neither the absorption of the nitrogenous constituents of the diet nor the absorption of the large quantities of fat contained in the diet were reduced, although Katz drank quantities of the mineral water that were larger than those ordinarily prescribed in practice.

We can add two other investigations to these experiments in healthy individuals, as follows: The first is an experiment on one of the authors; the second is an experiment performed on our laboratory servant, S.

## EXPERIMENT ON C. DAPPER

	Daily ingesta in grams		Loss in the fæces in grams		Loss in per cent. of ingesta		Remarks
	N.	Fat	N.	Fat	N.	Fat	
1st period, average of 4 days.	20.40	112	1.64	1.47	7.0	1.5	No Laxative. Stool formed.
2d period (4 days)	20.76	112	1.89	2.80	8.0	3.0	300 c. c. each day of Kissingen Bitter water. Stool thin.

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## EXPERIMENT ON C. DAPPER—Continued

	Daily ingesta in grams		Loss in the faeces in grams		Loss in per cent. of ingesta		Remarks
	N.	Fat	N.	Fat	N.	Fat	
3d period (4 days)	19.94	112	1.84	4.1	9.0	4.0	500 c. c. Kissingen Bitter water each day. Stool thin.
4th period (7 days)	20.92	112	0.76	1.48	4.0	1.5	No Laxative. Stool formed.

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	Daily ingesta in grams		Loss in the faeces in grams		Loss in per cent. of ingesta		Remarks
	N.	Fat	N.	Fat	N.	Fat	
1st period (7 days)	16.75	137	1.62	5.3	9.0	4.0	No Laxative.
2d period (9 days)	17.65	137	1.40	4.7	7.0	3.0	1 day 600 c. c. Rakoczy. 5 days each 900 c. c. Rakoczy. 1 day stool pul-taceous; on the other days thin.
3d period (8 days)	17.20	137	1.41	2.6	8.0	2.0	No Laxative. Stool formed.

It may be well to mention in connection with this report that in Dapper's case (the subject being perfectly healthy) an endeavor was made at the same time to reduce fat, and that in the course of the nineteen days of the investigation a loss of 3.5 kilos was brought about. It will be seen clearly from the table that in spite of the enormous consumption of Rakoczy and Kissingen Bitter waters, despite the energetic action

of the bowels that was brought about by the use of these waters, and despite the enormous consumption of fat that greatly exceeded the customary quantities eaten here in Germany, the food was exceedingly well assimilated. The fluctuations observed on the different days on which water was taken and water was not taken lie strictly within the boundaries that are observed in healthy subjects on different days, when they are living on a similar dietary.

We can now report the important experiments that were performed on patients. One such investigation has already been reported, namely, the experiments carried out by von Noorden on the patient suffering from habitual constipation. To a certain extent, Dapper's investigation on himself also belongs to this category, inasmuch as a certain therapeutic aim was sought after during the time the investigation was carried on, namely, a reduction of fat.

I. EXPERIMENT ON MRS. K. L.; OBESITY

	Daily ingestion in grams		Daily loss in the stools in grams		Loss in per cent. of ingesta	
	N.	Fat	N.	Fat	N.	Fat
First period, average of 9 days*	14.36	40.0	1.0	2.9	6.7	7.0
Second period, average of 9 days†	14.72	38.0	1.24	3.7	8.0	9.0
Third period, average of 13 days‡	14.9	36.0	1.28	4.4	8.0	10.0

\* No laxative.

† Six days, each 450; 2 days, each 650; 1 day, 900 c. c. Rakoczy.

‡ Two days, each 900 c. c. Rakoczy.

Two days, each 900 c. c. Rakoczy + 100 c. c. Kissingen Bitter water.

Three days, each 300 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.

One day, 500 c. c. Rakoczy, + 200 c. c. Kissingen Bitter water.

Three days, each 600 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.

Two days, each 300 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.



In the foregoing and following experiments we have given a few observations on the utilization of the food in cases undergoing the reduction cure, all of the patients taking Kissingen water during the period of observation.

## 2. EXPERIMENT ON MRS. ST.; OBESITY

	Daily ingestion in grams		Daily loss in the stools in Grams		Loss in per cent. of ingesta	
	N.	Fat	N.	Fat	N.	Fat
First period, average of 5 days*	15.0	40.0	0.93	3.08	6.0	7.0
Second period, average of 4 days†	14.67	40.0	0.66	2.82	4.0	7.0
Third period, average of 8 days‡	15.35	36.0	0.61	2.36	4.0	6.0
Fourth period, average of 10 days§	11.84	32.5	0.81	2.38	4.0	7.0

\* No laxative.

† Menses. No laxative.

‡ Two days, each 900 c. c. Rakoczy.

Two days, each 900 c. c. Rakoczy + 100 c. c. Bitter water.

Four days, each 300 c. c. Rakoczy + 200 c. c. Bitter water.

Stools partly thin and watery, partly pultaceous.

§ Ten days, each 300 c. c. Rakoczy + 200 c. c. Bitter water.

Stool pultaceous.

The following experiment is of great importance, because it concerns an invalid who had serious digestive disorders. The patient was suffering from gastrectasis, and an advanced degree of hypersecretion and hyperacidity, together with obstinate constipation. The patient was much emaciated. She was fed on milk, zwieback, butter, and scraped meat. The amount of food was calculated to increase the weight of the patient. In view of the condition of the stomach and the tendency of this patient to constipation, Kissingen Rakoczy mixed with equal parts of Bitter water was given.

	Ingestion each day in grams			Output each day in faeces		Remarks
	N.	Fat	Carbohy- drate	N.	Fat	
1st period 7 days	14.8	100	150	0.53	3.24	No Laxative. Stool solid. Daily, 200 c. c. Rakoczy and 100 c. c. Bitter water. Stool pultaceous.
2d period 5 days	15.14	100	150	0.49	2.91	

One hundred grams of fat are a considerable quantity to give a patient suffering from gastric trouble and general poor health. Only a few years ago one would hardly have dared to give so much fat to a sufferer from gastric disease. Von Noorden was the first to show that such large quantities of fat may not only be permissible in stomach trouble, but that they are often actually indicated. How anxiously one endeavored formerly to withhold fat of any kind from patients suffering from stomach trouble, and how one dreaded above all to give large quantities of fat together with strong saline mineral waters! In this particular case the combination of fat and saline mineral water produced most excellent results. The subjective sensations of the patient improved considerably; the action of the bowels was regulated, so that defecation proceeded promptly; the body weight increased. In the course of the first seven days of the cure (without mineral water) the patient's weight increased from 41 kilos to 41.5 kilos; on the following five days (with mineral water) to 42.8 kilos, and then

in the course of the next week, while the same treatment was continued (but no further analyses of the fæces were undertaken), the weight increased another 0.7 kilo.

Another investigation concerns a patient with gastric catarrh following alcoholic excesses. The man was also suffering from incipient phthisis, causing slight febrile movements during the course of the investigations. We have already had something to say about this particular case (Bünt) above. We called attention to the fact that we succeeded in increasing the production of hydrochloric acid by the administration of Kissingen Rakoczy. During the course of the investigation this patient daily ate the following articles of diet (carefully analyzed): 100 grams of chopped meats; 95 grams of eggs, 1 liter of milk, 200 grams of white bread, 200 grams of potatoes, 120 grams of butter, 60 grams of sesame oil, 600 c. c. of meat broths, 100 grams of raw apple, 1 bottle of artificial carbonated water, and 60 c. c. of brandy. The total values of the daily food were as follows: 13 grams of N., 250 grams of carbohydrates, 175 grams of fat.

	Fat in fæces in each day	Fat in fæces in per cent. of intake	Remarks.
Fore-period, average of 4 days	13.0	7.5	Stool once a day.
Drinking period, average of 3 days	12.0	7.0	Daily 600 c.c. of Rakoczy. Twice daily a thin stool.

During the course of the experiment the patient gained 0.8 kilo.

The investigations just reported constitute the only therapeutic experiments performed on sufferers afflicted with serious gastric disease, in which metabolic experiments on the influence of mineral waters were undertaken. We found that in none of the cases were even the slightest digestive disorders produced. We have a large number of cases on record in which Kissingen water and large quantities of fat were given in stomach patients, without any report of metabolic studies. In some cases we even went much further with the administration of fat, and gave as much as 250 grams a day, or even more, with the very best results. In fact, we feel justified in making the statement that it was much easier to give large quantities of fats without objection on the part of the patient, and without detriment to the patient afflicted with stomach trouble, if some saline mineral water was administered at the same time than without the saline water. There is nothing to show that fat and saline waters are incompatible, and any teachings to this effect must be regarded as fairy tales that have gained popular credence in certain watering places. The belief in this antagonism is a dangerous one, because many patients on the strength of this popular prejudice are deprived of the fat, which is necessary to improve their general nutrition.

To the above investigations we add a brief communication on the digestion of fats, as observed in

two sufferers from gout. No complete investigation of the assimilation of the fat was performed in these cases; the quantity of fat that was consumed on three consecutive days was simply determined, and the fæces passed during this time were analyzed for fat. During the course of this investigation (as well as on the ten days preceding), the patients both drank 600 c. c. of Homburg Elizabeth water in the morning on an empty stomach, and 200 c. c. more of the same water in the afternoon at five o'clock.

The first patient had suffered a number of gouty attacks, and had been so frightened by the varying and contradictory dietetic regulations that had been imposed upon him by his numerous medical advisers that he hardly dared to eat a square meal. He had lost about forty pounds in weight during the course of one year, so that at the time he came under our observation he weighed only 102 pounds. In addition, he was very much constipated, and suffered from distention of the bowels with gas. He was told to eat a diet containing very much fat and an abundance of other articles. On the three days during which he was under observation he ate between 180 and 200 grams of fat a day, and the fæces during this time contained 5.1 grams of fat each day. One can say, therefore, that the assimilation of fat was faultless. His digestive disturbances improved considerably during the course of the treatment. He gained 5.1 kilos in three weeks, and his general strength improved enormously. If this patient had been treated according to

the customary scheme that calls for the exclusion of fat, he presumably would have left the watering place in a worse condition than when he came there.

Similar conditions were observed in the second patient, who was suffering from typical gout. He had suffered a number of severe gouty attacks in the spring of 1900, and had lost much strength, partly as the result of the attacks themselves, and partly because he had imposed certain rigid dietary restrictions upon himself. Whereas he weighed about 80 kilos in the winter preceding these attacks, he now only weighed 66.5 kilos. An analysis of the stomach contents revealed a considerable degree of hyperacidity (acidity, 0.38 per cent.; free hydrochloric acid, 0.24 per cent.). At the time when this analysis was performed, one of the joints of his foot was still in a condition of gouty swelling. He was placed upon a diet containing  $\frac{3}{4}$  of a liter of cream, with 30 per cent. of fat; 200 grams of butter, 6 eggs, and Graham bread, dishes made from flour, plenty of vegetables and fruit, and once a day an abundance of meat of any kind (with the exclusion of internal organs). In addition, he received 400 c. c. of Homburg Elizabeth water in the morning on an empty stomach, and in the evening before retiring 3 grams of sodium bicarbonate, dissolved in 200 c. c. of Seltzer water. The eggs, cream, and butter contained about 280 grams of fat. The fat contained in the other articles of diet was not determined, but amounted to at least 20 grams, so that the patient approximately consumed

300 grams of fat a day. The fæces deposited during the next four days contained 24.4 grams of ethereal extract, so that every 300 grams of fat contained in the diet deposited an average of 6.1 grams only of fat in the fæces a day, amounting to 2.03 per cent. This sum, it will be seen, is far below the normal average. At the end of three weeks the patient had gained 6.2 kilos; the gastric contents examined three-quarters of an hour after a test breakfast showed an acidity of 0.26 per cent. The gouty swelling that at the beginning of the treatment was already in a retrogressive stage had completely disappeared, and no trace of it had remained. In the three years and a half that have intervened since that time, the patient suffered only one mild gouty relapse.

Finally, we desire to report the case of a patient with diabetes mellitus. In this disease it is important to give as much fat as possible with the diet, particularly if the carbohydrates must be much reduced. If it were true that fat and saline mineral waters cannot be taken together, then the latter should be excluded from the dietary of diabetics. We can hardly refrain from concluding that many patients afflicted with severe forms of glycosuria are rendered weaker by a sojourn at one of the watering places simply because so many of the attending physicians exclude fat from the diet or at least reduce it considerably. In general, there is not the slightest reason for doing this, and in case a patient should really be found now and then in whom the saline water and a diet containing much

fat do not seem to agree, then a conscientious physician should certainly reason that the fat is much more important for the patient than the particular saline water of the watering place.

In our investigation we intentionally, for the sake of the experiment, created extreme conditions, that is, we gave abnormally large amounts of fat with unusually large amounts of mineral water. The patient suffered from a mild degree of glycosuria. He reported a gouty history, and as a result of poor care and food at home was very much reduced. The goal that we aimed at was to give this patient an abundant diet, and in this way to attempt to give him strength. This goal was reached, for the patient who entered the hospital in a miserable condition was dismissed at the expiration of a few weeks, fully capable of performing his work and earning his living. His daily diet consisted, on an average, of 400 grams of Rademann's "Erdnussbrod"; 140 grams of eggs; 120 grams of butter; 60 grams of cheese; 250 grams of beef; 20 grams of lard; 50 grams of bacon; 150 grams of sauerkraut; 200 grams of sausage; 30 grams of dried cabbage, (prepared with meat broth and bacon); 700 c. c. of coffee; 650 c. c. of meat broth, and 400 c. c. of beer. The food was carefully analyzed. The following table shows the utilization of this food, with and without the addition of Homburg Elizabeth water.



	Daily ingestion in grams		Output in the fæces in grams		Output in the fæces in per cent. of the intake		Remarks
	N.	Fat	N.	Fat	N.	Fat	
1st period (3 days)	29.4	242	3.0	20.91	10.0	8.7	
2d period (5 days)	29.8	249	2.8	26.77	9.5	10.7	600 c. c. Homburg water
3d period (3 days)	30.1	261	3.26	27.23	10.8	10.4	800 c. c. Homburg water.

The general health of this patient was excellent throughout the time he was taking the mineral water, and his appetite splendid. He had a movement of the bowels from one to three times a day, the stools being of a pultaceous consistency. As will be seen from the table, the absorption of the food was in no way impaired by the enormous quantities of saline water that the patient drank. This was the more remarkable because in this instance the absorption of fat was less favorable from the beginning than is ordinarily the case. According to the statement made by Von Noorden in his text-book, only about 6 per cent. of the large quantities of ingested fat should properly reappear in the fæces. In this particular case 8.6 per cent. appeared in the stools, even before Homburg water was administered. This loss of fat was slightly increased when 600 c. c. of Homburg water were taken, although the increase was so small that it was almost a negligible quantity. Later, even

though the amount of water was increased, the loss of fat as compared with the amount of fat ingested decreased again. We are inclined to attach no importance whatever to these fluctuations, for they occur within the same boundaries in any healthy subject. We attach particular importance, however, to the main result of this study, namely, that no marked *decrease* in the assimilation of fat occurred, despite the simultaneous administration of maximum quantities of fat and mineral water together.

In order to test the effect of other mineral waters and salt mixtures on the absorption of fat, we performed another investigation with Carlsbad Sprudel salt. This investigation was published some time ago. The daily diet in this case consisted of 400 grams of chopped beef, 150 grams of white bread, 400 grams of potato, 125 grams of butter, 500 c. c. of coffee, and 1500 c. c. of beer.

	Daily ingestion in grams		Loss in the faeces in grams		Loss in faeces in per cent. of intake	
	N.	Fat	N.	Fat	N.	Fat
First period (4 days) . . . . .	17.53	115	1.0	1.5	5.7	1.3
Second period (6 days) . . . . .	17.80	115	1.8	2.5	10.0	2.1
Third period (7 days) . . . . .	17.90	115	1.1	1.7	6.2	1.4

During the second period the patient received 16 grams of Sprudel salt daily, in 100 c. c. of water, in

the morning on an empty stomach. From two to three thin evacuations of the bowels occurred daily. The result of this treatment was that the loss of nitrogen was somewhat increased, while the loss of fat stayed well within the normal boundaries. In the meantime, basing on this preliminary experiment, the absorption of fat under the influence of Carlsbad mineral water was subjected to further clinical and experimental study by Dr. Friedrich Kraus, Jr., in the laboratory of the Municipal Hospital in Frankfurt-on-the-Main, under von Noorden's direction; in all of the cases the fat that was administered (and this exceeded normal quantities) was not only splendidly absorbed, but also borne without detriment by the patient. The cases studied in this direction were one patient suffering from chronic intestinal catarrh, one suffering from arthritis urica, and one from gastric ulcer.

Since that time, a number of other authors have performed similar experiments; for instance, C. Brandenburg, in a patient undergoing a cure with artificial Carlsbad Mühlbrunnen water; by M. Jacoby, in a patient using Apenta water; and by E. Allard, in a patient using the stronger saline Mergentheimer Carlsquelle water (in diabetes mellitus, and in obesity). The absorption of fat either remained unchanged, or was slightly improved or slightly decreased in the periods during which the mineral water was taken, as compared to its absorption during the control periods in which no mineral water was

administered. If one is fairly well versed in interpreting such investigations, one will agree that the differences found by these different authors, immaterial in what direction they deviated from so-called normal values, were quite insignificant, and must be considered to lie within physiological limits. From all these experiments one conclusion can be drawn, namely, that the old dogma that fats are to be interdicted when a course of mineral waters is being undertaken is mere superstition and must be relegated to the realm of fairy tales.

### III. ON THE INFLUENCE OF SALINE MINERAL WATERS ON THE METABOLISM OF PROTEIDS.

THE well-known experiments of C. von Voit showed that the use of sodium chloride increased the excretion of urea. Dehn performed similar experiments in healthy human subjects with potassium chloride, and obtained the same results. Voit conceded that the increased excretion of urea was in part due to flushing of the tissues as the result of the increased ingestion of water. In addition, however, he postulated from his experiments that the administration of sodium chloride also produced "a slight increase in the metabolism of albumin." He based his conclusion on the observation that in the course of the forty-nine days during which the animal was under observation, 105 grams of urea more were excreted than were taken in with the food. (Handbook, p. 159.) Weiske performed similar experiments in sheep, and also arrived at the same conclusion. Dubelir, under Voit's direction, performed still other experiments, and arrived at a different conclusion, namely, that the excretion of nitrogen (in dogs) was reduced if sodium chloride was added to the diet.

In addition to these animal experiments, a number of investigations in human subjects have been

performed, and the results obtained from these investigations must be compared with the animal experiments. J. von Mering found that the excretion of urea was increased slightly after the ingestion of Friedrichshall Bitter water. Mosler performed some investigations with the same water, and obtained less marked results, and B. Markwald investigated the same question with the same water, and found that the excretion of urea was slightly reduced. Although all these older experiments yielded contradictory results, as far as the investigations in human subjects were concerned (Mosler, von Mering, Markwald), and were far from convincing, the old idea of von Voit still predominates in the minds of most writers, and is incorporated in all text-books and in all the pamphlets that are published in the different watering places; for in all of them one can read that saline waters increase the metabolism of albumin. One should never forget, however, that this is merely a broad deduction from the isolated fact originally announced by von Voit, that in dogs the excretion of urea is slightly increased under sodium chloride. This conclusion in regard to the metabolism of albumin was only very conservatively pronounced by von Voit himself. In fact, there can be no doubt that this statement needs corroboration before it can be accepted. Nevertheless, the doctrine was soon accepted by a large circle of physicians, and was ultimately amplified to read, "that saline waters accelerate metabolism." Here the two ideas of an increase in the metabolism of albumin and

an acceleration of metabolism in general were used synonymously without justification, and this error has crept into our modern literature, showing in many instances that the authors of the articles in which this egregious error is committed are unfamiliar with the fundamental rudiments of our knowledge of metabolism.

If we do not attach too much importance to these more or less random statements, then the old doctrine that sodium chloride and saline mineral waters increase proteid metabolism still remains to be critically investigated. It is necessary, of course, to consider experiments performed in human beings alone, and to subject each one of these investigations to the most rigid criticism. Only the experiments of J. Katz stand the light of critical illumination; all the other experiments that were published before our own do not come up to this standard. Katz, during the period of investigation, lived on a diet of absolutely uniform composition and of known constitution (17.14 grams of N., 125.43 grams of fat, and 310.85 grams of carbohydrate), and assimilated, *i. e.*, retained, 1.589 gram of N., during the fore-period; 1.356 gram during the saline water period; 1.593 gram during the after-period. The differences observed are within the boundaries of error, so that one can say positively that the metabolism of albumin was not increased.

This experiment performed on a healthy subject is not sufficiently conclusive for our purposes. What we need are experiments in sick people. We will have

occasion to speak later of the necessity of such experiments.

First Experiment. Miss F., suffering from gastrectasis, hypersecretion, and hyperacidity of the gastric juice. (See above.) The diet during the whole experiment consisted of 2 liters of milk, 80 grams of zwieback, 40 grams of butter, 80 grams of meat a day. The diet was most carefully analyzed in this experiment, for this is absolutely necessary whenever the attempt is made to gain information in regard to the metabolism of the proteids.

During the fore-period (seven days) the diet on an average contained 14.8 grams of N.; the urine and fæces together, 3.1 grams of N. a day.

During the water period (200 c. c. of Rakoczy and 200 c. c. of Kissingen bitter water) the diet during the period of five days contained 15.4 grams of nitrogen; the fæces and urine together 12.8 grams of nitrogen a day.

No increase in the assimilation and disassimilation of albumin could be determined with certainty, nor could the reverse be discovered, for the figures fluctuated within normal boundaries.

Second Experiment. Mrs. Kl. (See above.) Obesity. The following table shows the nitrogen metabolism during a reduction cure, that this patient underwent:



	Calories introduced into the daily diet	Daily N. balance	Daily loss of weight in grams
First period, Average of 9 days* . . . . .	1491	+0.14	96
Second period, Average of 9 days† . . . . .	1292	+0.46	106
Third period, Average of 13 days‡ . . . . .	1157	+0.61	298

\* No laxative, no sweat.

† Six days, each 450; 2 days, each 650; 1 day, 900 c. c. Rakoczy.

‡ Two days, each 900 c. c. Rakoczy.

Two days, each 900 c. c. Rakoczy, + 200 c. c. Kissingen Bitter water.

Three days, each 300 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.

One day, 500 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.

Three days, each 600 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.

Two days, each 300 c. c. Rakoczy + 200 c. c. Kissingen Bitter water.

Three sweat baths, with but little sweating.

Third Experiment. Mrs. St. (See above.)

Obesity. The following table shows the nitrogen metabolism during a reduction period.

	Calories introduced with the daily diet.	Daily N. balance	Daily loss of weight in grams
First period, average of 5 days* . . . . .	1495	+1.76	366
Second period, average of 4 days† . . . . .	1486	+0.62	17**
Third period, average of 9 days‡ . . . . .	1264	+0.89	60
Fourth period, average of 8 days§ . . . . .	1178	+0.46	300
Fifth period, average of 4 days   . . . . .	1171	+0.41	125
Sixth period, average of 10 days¶ . . . . .	1012	+0.02	140

\* Four days continued menstruation. Constipation. Rectal injections.

† No laxative. No exercise. Stools constipated. Injections.

‡ Six days, each 450; 2 days, each 650; 1 day, 900 c. c. Rakoczy. Stool pultaceous.

§ Two days, each 900 c. c. Rakoczy.

Two days, each 900 c. c. Rakoczy + 100 c. c. Bitter water.

Four days, each 300 c. c. Rakoczy + 200 c. c. Bitter water.

One hot bath, little sweating, stools pultaceous, partly watery.

|| Three days, each 300 c. c. Rakoczy + 100 c. c. Bitter water. One day each, 300 c. c. Rakoczy + 200 c. c. Bitter water, stool pultaceous.

¶ Ten days, each 300 c. c. Rakoczy + 200 c. c. Bitter water, stool pultaceous.

Four hot baths, but little sweating.

\*\* Daily gain in weight in grams.

From both of these experiments the conclusion can be drawn that the ingestion of considerable quantities of this mineral water exercises no effect on proteid metabolism. These investigations in patients undergoing a reduction cure are particularly important, because we know that in reduction cures the proteid content of the body is always in danger. If the waters exercised any influence whatever on the proteid metabolism, then this effect should certainly become apparent in these experiments, for in such cases it is always difficult to maintain nitrogen equilibrium.

We call attention to three other metabolic experiments that were performed in a healthy subject, in a subject undergoing a reduction cure, and in a patient with diabetes mellitus. It would be too tedious to report the details of these investigations in this place. We will simply state that the administration even of considerable quantities of Kissingen Rakoczy water (500 to 700 c. c.) exercised no influence on the metabolism of the proteids.

In the meantime, a number of other similar experiments have been performed. H. Leber, who also carried on his investigations in vonNoorden's laboratory, found that the administration of Homburg Elizabeth water (750 c. c.), if anything, reduced the metabolism of proteids as compared to the fore-period. Brandenburg, as already mentioned, administered artificial Carlsbad Mühlbrunnen. Jacoby used Apenta water. Allard, Mergentheim Carlsbrunnen water. In none of

these cases was an increase in the nitrogen output discovered. Jacoby and Allard called particular attention to the fact that they were able, just as we were, to carry on energetic reduction cures with the aid of these mineral waters without at the same time increasing the nitrogen metabolism, and in this way depriving the organism of albumin.

We will not enter into a discussion of some of the more recent animal experiments, and of some other experiments in healthy adults, in which the effects of large quantities of sodium chloride on proteid metabolism were studied. These investigations are theoretically of some interest, but permit of no conclusions in regard to the clinical and balneological features of the question. All that we are trying to discover is what effect the common balneologic measures that are universally adopted and practiced exercise on metabolism. Whether the salts contained in these different waters, when given in abnormally large quantities, exercise an influence on proteid metabolism or not, is of subordinate practical importance, but is, of course, of considerable toxicologic interest.

On the other hand, it seemed very desirable to determine by convenient, and at the same time, reliable methods, in a considerable number of cases, whether or not the saline waters, as ordinarily administered, cause a loss of body nitrogen. For this purpose we selected a number of patients undergoing a reduction cure, chiefly because in such cases a loss of nitrogen was particularly to be dreaded, and because it is a

matter of great practical importance to prevent such a loss.

We adopted the following method, that one of us (Dapper) employed in a large number of patients in his Kissingen sanitarium. The patients received daily a diet of known quality and quantity. From time to time (according to the requirements of the individual case) they received for two or three days in succession a diet that contained the same amount of proteid, fat, and carbohydrate as the diet taken before this period, but this was composed in such a way that its proteid content and its caloric value could be calculated very easily and at the same time very accurately; namely, a weighed quantity of meat containing little fat, broiled; a weighed quantity of bread, eggs, butter, pastry, and fruit of known composition, black coffee, bouillon from which the fat had been removed, Moselle wine, mineral water, etc. It was unnecessary to perform careful analyses of the diet in the cases that were fed in this way. After these patients had lived on the same diet for one or two days, the twenty-four hours' quantity of urine was carefully collected and its nitrogen determined. The nitrogen of the fæces was valued in all cases at 1.5 gram (that is really too little for a diet constituted as above). From the intake and output the nitrogen balance could readily be calculated, and one could determine whether the regimen, that is, the diet, exercise, bathing, and the drinking of the saline water, together, produced a considerable loss of nitrogen or not. Dapper reported his results in

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twenty-eight cases that were examined in this way some years ago. Below will be found a table giving the results obtained in twenty-one other cases.

Name and age	Weight in the beginning in Kg.	Duration of the treatment (weeks)	Ingesta in grams	N. balance.		Caloric value of the food per kilo of body weight	Daily exercise in hours	Daily quantities of Rakoczy Bitter water	Loss of weight during the cure in kg.
				Date	Grams				
1. Baron F. 39 Y.	124.5	4½	24.0-26.0	3/5/'07	-0.7	15-17	3-6	150 Ra. + 100 Bi.	15.2 kg.
				6/5/ "	+0.4				
				15/5/ "	+0.8				
				29/5/ "	+0.7				
2. Mr. K. 42 Y.	135.5	5	23.0-28.0	9/6/'07	+0.4	14-16	3-4	100 Ra. + 100 Bi.	16.4 kg.
				5/6/ "	-0.5				
				20/6/ "	+0.7				
				24/6/ "	+0.8				
3. Mrs. v. St. 37 Y.	105.4	4½	20.0-22.0	7/7/'07	-0.6	13-15	1-3	250 Ra.	10.3 kg.
				10/7/ "	+0.3				
				25/7/ "	-0.6				
				5/8/ "	+0.7				
4. Mr. A. 62 Y.	112.0	4½	21-33	10/5/'08	+0.5	13-15	1½ -3	150 Ra. + 100 Bi.	11.0 kg.
				13/5/ "	+0.7				
				28/5/ "	-0.5				
				15/6/ "	+0.8				
5. Miss C. 16 Y.	112.0	5	21-23.0	7/6/'08	-0.2	13-15	2-3	150 Ra. + 50 Bi.	14.0 kg.
				10/6/ "	+0.5				
				24/6/ "	+0.7				
				11/7/ "	+0.6				
6. Mr. F. 46 Y.	103.5	4½	21-22.0	4/9/'08	+0.5	14-15	3-6	200 Ra. + 100 Bi.	11.5 kg.
				7/9/ "	-0.4				
				22/9/ "	+0.6				
				3/10/ "	+0.7				
7. Mr. St. 53 Y.	113.0	4	23-24.0	7/5/'09	-0.6	13-15	2-5	150 Ra. + 100 Bi.	13.0 kg.
				10/5/ "	+0.2				
				24/5/ "	+0.7				
				3/6/ "	+0.6				
8. Mrs. S. 53 Y.	109.0	4½	22-23.0	5/4/'09	+0.3	14-16	2-5	250 Ra. + 50 Bi.	9.8 kg.
				8/4/ "	+0.6				
				22/4/ "	+0.8				
				5/8/ "	+0.6				
9. Mr. v. D. 35 Y.	117.0	4	23-24.0	7/8/'09	+0.4	13-14	1-3	300 Ra.	11.3 kg.
				10/8/ "	+0.8				
				25/8/ "	+0.9				
				5/9/ "	+0.8				
10. Mr. R. 28 Y.	111.0	4½	22.5-23.5	10/5/'09	+0.2	15-16	2-4	300 Ra.	10.0 kg.
				13/5/ "	+0.5				
				25/5/ "	+0.6				
				11/6/ "	+0.4				

Name and age	Weight in the beginning in kg.	Duration of the treatment (weeks)	Ingesta in grams	N. balance.		Caloric value of the food per kilo of body weight	Daily exercise in hours	Daily quantities of Rakoczy Bitter water	Loss of weight during the cure in kg.
				Date	Grams				
11. Mrs. G. 48 y.	87.2	4	19-20.5	7/7/'00	+0.4	13-14	1-2	100 Bi.	8.0 kg.
				10/7/"	+0.3				
				22/7/"	+0.2				
				5/8/"	+0.8				
12. Mr. v. W. 61 y.	109.5	4	22.0-23.0	25/8/'00	+0.3	13-15	3-5	200 Ra. + 50 Bi.	10.3 kg.
				28/8/"	+0.7				
				10/9/"	+0.6				
				22/9/"	+0.8				
13. Mr. Referendar B. 25 y.	107.2	4	21.5-23.0	7/5/'01	+0.3	13-14	3-4	250 Ra. + 50 Bi.	9.6 kg.
				10/5/"	+0.4				
				15/5/"	+0.4				
				18/5/"	+0.5				
				10/6/"	+0.5				
14. Mrs. H. 36 y.	133.8	5	25-26.0	20/6/'01	+0.3	15-17	2-4	100 Ra. + 100 Bi.	14.0 kg.
				23/6/"	+0.4				
				6/7/"	+0.5				
				25/7/"	+0.6				
15. Mr. K. 41 y.	152.0	5	26-27	5/8/'01	+0.2	15-17	3-6	150 Ra. + 150 Bi.	17.0 kg.
				8/8/"	+0.4				
				23/8/"	+0.7				
				10/9/"	+0.8				
16. Mr. F. 33 y.	95.3	4½	19-20.0	8/5/'02	+0.3	14-15	2-4	250 Ra. + 50 Bi.	9.5 kg.
				11/5/"	+0.3				
				28/5/"	+0.8				
				10/6/"	+0.7				
17. Mrs. A. 41 y.	109.3	5	21-22	7/7/'02	+0.7	14-15	1½-2½	100 Bi.	11.0 kg.
				10/7/"	+0.2				
				14/7/"	+0.3				
				24/7/"	+0.3				
				12/8/"	+0.6				
18. Mr. W. 41 y.	147.0	5	27-29	9/9/'02	+0.4	15-17	3-6	150 Ra. + 150 Bi.	17.3 kg.
				12/9/"	+0.6				
				23/9/"	+0.1				
				13/8/"	+0.7				
19. Mr. N. 29 y.	113.0	4½	23-24	12/6/'02	+0.3	14-15	4-5	200 Ra. + 100 Bi.	13.7 kg.
				15/6/"	+0.5				
				28/6/"	+0.7				
				12/7/"	+0.6				
20. Mrs. H. 47 y.	84.9	—	19-21	5/5/'02	+0.4	13-14	2-3	150 Ra. + 50 Bi.	7.6 kg.
				8/5/"	+0.3				
				19/5/"	+0.6				
				3/9/"	+0.7				
21. Mr. v. O. 43 y.	113.5	4	23-24	3/9/'02	+0.2	14-16	3-5	150 Ra. + 100 Bi.	14.3 kg.
				6/9/"	+0.3				
				20/9/"	+0.6				
				1/10/"	+0.8				

The significance of this table can readily be understood; and one can see that, with very slight exceptions, the reduction cure could be arranged in such a way at any time, even while Kissingen Rakoczy and Kissingen Bitter water were taken, that the nitrogen equilibrium was maintained at a favorable level, even though the loss of body weight was considerable and rapid.

We may say, therefore, that the acceleration of the proteid metabolism which is so much dwelt upon in the literature of watering places does not occur when saline mineral waters are used. The question arises whether or not this detracts in any way from the therapeutic value of saline mineral water. In the eyes of those clinicians who babble the metabolic jargon of past ages without understanding what they are talking about, this conclusion may possibly be interpreted to signify that the therapeutic value of these waters is depreciated—as a matter of fact, however, this is not at all the case. If it were true that sodium chloride *per se* increased proteid metabolism, that is, increased the combustion of albumin within the cells, then this should become manifest in metabolic investigations by an increase in the nitrogen output. In other words, more nitrogen should be excreted in the fæces and the urine than is administered by mouth. Such a perversion of the nitrogen economy is only seen in processes that are accompanied by a destruction of protoplasm,—in the most classical form, in fevers, and in phosphorus poisoning. Whoever, therefore, claims that saline

waters increase the metabolism of proteids independently of the character and the quantity of the diet, must postulate that sodium chloride in some way attacks the cells themselves; in other words, that it is a protoplasmic poison; or otherwise he must wish to give a new significance to the conception "increase of proteid metabolism." If proteid metabolism were really increased, then it would be our duty to warn our patients against all drinking cures, for the latter are, as a rule, intended to strengthen the patients and to build them up. We have seen that no such thing as a loss of proteid really occurs, and we do not refrain, therefore, from instituting an energetic reduction cure, together with a drinking cure, in many patients who are suffering, for instance, from heart disease; for we are certain that the metabolism of proteids remains at a favorable level, and that no serious nutritive disturbances are produced by this treatment. The truth of this idea has been borne out by our practical experience, for in none of the cases that we have treated in this way have we ever noticed any detriment to the general well-being of the patients, either during the reduction cure or afterwards. On the contrary, the patients without exception grew stronger under this treatment and more capable of performing their labors.



#### IV. ON THE INFLUENCE OF SALINE MINERAL WATERS ON THE EXCRETION OF URIC ACID.

Saline mineral waters belong to that group of waters that is employed in the treatment of the uric acid diathesis, and we believe that great therapeutic advantages may accrue from the use of these waters in this condition. We merely call attention to the old and well-established reputation in this direction that Homburg in particular has acquired, particularly among English physicians. In view of all this, it is peculiar that so little has been written in regard to the influence of these waters on the excretion of uric acid. True, there are some older investigations on record, especially the investigations of Genth, with the waters of Wiesbaden, but none of the older publications on the excretion of uric acid can be utilized nowadays, since we know how inexact the old methods of uric acid determination are. Compare the remarks by von Noorden on this subject in his text-book on "The Pathology of Metabolism," page 52. Neither can we utilize the sporadic publications from the pens of a number of physicians in Wiesbaden, simply because these publications deal with isolated data and not with continued series of investigations.

Isolated data are of very little value, for in inter-

preting the clinical significance of fluctuations in the uric acid excretion large or medium or small figures for the uric acid of the urine should be utilized only with much conservatism. There is undoubtedly much confusion in regard to this matter in all of the literature on the treatment of the uric acid diathesis. We may find that one author warmly recommends a certain remedy, because it decreases the excretion of uric acid, whereas another author praises another remedy with equal enthusiasm because it increases the excretion of uric acid. Which of the two is right?

In contradistinction to older teachings, we are justified nowadays in saying that that method of treatment is the best that causes the maximum excretion of uric acid, assuming always that the diet is the same during the periods that are used for comparison. The uric acid appearing in the urine and the other urinary purin bodies probably do not represent the total quantity of these substances that are generated in the organism. They constitute, however, a definite and a very constant proportion of the total uric acid. If this were not the case, such uniform values for the endogenous and exogenous purin bodies of the urine would not be found. We do not agree altogether with the statement made by Burian and Schur, and also, with certain modifications, by O. Loewi, that a certain and definite quantity of purinnitrogen appears in the urine for each definite quantity of purin bodies (nuclein) that is introduced by mouth; for Kaufmann and Mohr have shown in a very thorough investigation, that they carried out

under the direction of von Noorden, that certain individual differences may be observed. In the same individual, however, provided the diet remains the same, the excretion of uric acid is fairly constant. We know no factor that is independent of the disease, or of the diet, that is capable of permanently increasing the excretion of uric acid, that, in other words, can increase the metabolism of nucleins, and in this way increase the uric acid. On the other hand, we know of a number of drugs, and we know of many measures, that are capable of increasing the uric acid of the urine for the time being, or of decreasing it. This means that, by employing these remedies or measures we are able to wash out the uric acid or cause its retention. We have every reason to include uric acid retention in the pathology of gout, and to welcome every measure that is capable of removing an excess of uric acid from the blood.

Let us see how the saline waters that we are discussing in this place (Homburg and Kissingen) act in this respect. The best opportunity for studying this question was offered in the course of those investigations that were performed in certain cases for other purposes, and in which the diet was constant and was being carefully controlled. Our first investigations were performed in a case of obesity, in a case of chronic alcoholism with incipient tuberculous phthisis of the lungs and slight febrile movements, and in a healthy individual, who, as was already known, excreted very large quantities of uric acid.

First Investigation. Obesity.

The diet during the whole course of the investigation contained daily 127 to 132 grams of albumin; 150 grams of carbohydrate; 112 grams of fat; 30 grams of alcohol. The total amount of fluid ingested each day was 155 c. c. On the days on which Kissingen Bitter water was taken, corresponding quantities of other beverages were omitted.

Fore-period of four days. Uric acid excretion, 1.1, 0.9, 1.0, 1.1 grams, an average of 1.0 gram a day.

Period of water-drinking of five days' duration. On four days 300 c. c., one day 500 c. c. of Kissingen bitter water. Uric acid excretion 1.3, 1.1, 1.3, 1.2, an average of 1.2 grams.

Second Investigation. Chronic alcoholism, with chronic gastric catarrh. Daily diet, 1 liter of milk; 100 grams of beef; 200 grams of white bread; 120 grams of butter; 60 grams of sesame oil; 1.40 grams of barley flour; 200 grams of potatoes; 600 c. c. of meat broth; 100 grams egg; 120 grams of apple; 60 c. c. of brandy; 700 c. c. of artificial carbonated water.

Fore-period of four days. Uric acid excretion 0.49, 0.54, 0.43, 0.41 grams, an average of 0.47 gram a day.

Period of water drinking of five days. Uric acid excretion while taking 600 c. c. of Rakoczy a day (omission at the same time of a corresponding quantity of the artificial carbonated waters), 0.58, 0.42, 0.52, 0.61, 0.45 grams, an average of 0.52 grams of uric acid a day.

Third Investigation. A healthy individual with a

large amount of uric acid in the urine. Daily diet consisted of 102 to 113 grams of albumin; 212 grams of carbohydrate; 137 grams of fat; 38 grams of alcohol. The daily amount of fluid was very high, owing to the warm summer climate, that is, 3000 c. c. On the days on which Rakoczy water was taken, corresponding quantities of ordinary water were omitted.

Fore-period of three days. Uric acid, 1.5, 1.7, 1.1 grams, an average of 1.4 grams.

Period of investigation of five days, with 900 c. c. of Rakoczy a day. Uric acid, 1.0, 0.9, 1.6, 2.2, 2.0 grams, an average of 1.54 grams a day.

It may not be superfluous to mention that the second day of this series was exceptionally hot, so that the patient perspired very freely, and the total quantity of the urine was reduced from 1700-1900 c. c. to 1530.

Period of investigation of three days, with 1200 c. c. of Rakoczy a day. Uric acid, 1.6, 0.7, 1.1, an average of 1.2 grams. Here, too, similar conditions obtained on the second day as on the corresponding day of the above series.

After-period of nine days. Uric acid, 1.2, 1.3, 1.4, 1.4, 1.5, 1.0, 1.4, 1.9, 1.7 grams, an average of 1.4 grams of uric acid a day.

H. Leber resumed these investigations later again under the direction of von Noorden, and arrived at the result that weak saline waters, taken in abundant quantities, as a rule increase the uric acid excretion slightly, but that occasionally they do not exercise any influence upon the uric acid excretion. During the drinking

cure he occasionally observed an increase in the uric acid output of as much as 0.2 grams a day.

All these investigations had this disadvantage, that they were not performed on patients suffering from gout. It may be worth while to mention, however, that in the first case reported by us, in which Rakoczky water produced a daily increase of the uric acid excretion of 0.2 grams, typical gout was added to the obesity two years later. In the meantime, von Noorden has reported a number of other investigations in gouty subjects, of which two may be given in this place.

Fourth Investigation. Prince Al. S. About fifty years old; much gout in the family. The patient has suffered for four years two or three attacks of podagra each year. He has a number of small tophi in the ears. The last attack occurred two months before the investigation was begun. During the whole experiment the daily diet consisted of one liter of milk; 400 grams of meat; 6 eggs; 250 grams of bread; 150 grams of butter; 200 grams of potatoes; 1 order of spinach or cauliflower or green beans; half a kilo of grapes; half a bottle of mild Rhine wine, and a bottle of Apollinaris water.

Fore-period of four days. Uric acid, 0.83, 0.77, 0.74, 0.76 grams. In addition, the urine daily contained 0.04 grams of nitrogen in the form of other purin bodies. Total purin nitrogen on an average, 0.298 grams.

Main period of five days, on the same diet. In addition, daily 600 grams of Homburg Elizabeth water.

Corresponding amount, that is, 600 c. c. of Apollinaris water, was omitted on these days. Uric acid, 0.08, 0.98, 0.99, 0.98 grams. In addition, an average daily excretion of 0.06 grams of other nitrogenous purins. Total purin nitrogen on an average, 0.369 grams.

After-period of four days. Diet as in the fore-period. Uric acid, 0.96, 0.90, 0.78, 0.80 grams. In addition, a daily average excretion of 0.35 grams of other purin nitrogen. Total purin nitrogen on an average, 0.313 grams.

Fifth Investigation. Doctor F. K., aged 55; frequent attacks of gout for fifteen years; chronic gouty changes in different joints; large number of tophi in the ears and on the hands. For about three months the patient has never been quite free from pain and swelling of the joints. During the whole period of investigation he was in bed or lying on the sofa. The subject was fairly obese, showed great muscular weakness, but had no fever.

The daily diet consisted of 400 grams of meat; 4 eggs; 2 to 3 tablespoonfuls of mashed potato; salad at dinner and supper; a plateful of oatmeal or barley; 150 grams of white bread with plenty of butter; 2 oranges; half a bottle of mild Bordeaux wine; one bottle of Apollinaris water.

Fore-period (four days): Uric acid, 0.534, 0.610, 0.564, 0.555 grams, an average of 0.566 grams.

Main period (five days): 800 c. c. of Homburg Elizabeth water are substituted in place of an equal amount of Apollinaris water.

Uric acid excretion: 0.571, 0.713, 0.854, 0.886, 0.798 grams, an average of 0.765 grams.

After-period (four days). Diet the same as in the fore-period. Uric acid excretion: 0.788, 0.692, 0.657, 0.642 grams, an average of 0.695 grams.

In both of these investigations the same result was obtained as in the cases previously published; particularly in the last case of irregular gout was the influence of the saline mineral water apparent, inasmuch as the uric acid excretion was favored, and, as we may conclude, the retention of uric acid in the organism was decreased.

These facts, that are corroborated by other clinical investigations, are so convincing that it is well worth while to pay more attention to the use of weak saline mineral waters in the treatment of gout.

A theoretical explanation of the uric-acid-expelling power of weak saline mineral waters can hardly be given. It is a well-known fact that uric acid is salted out of its solutions by strong sodium chloride solutions. Sodium chloride solutions of such concentration, however, never occur in the blood and tissue juices. We are at present engaged in studying this question.

We find only a very short notice in regard to other investigations performed with reliable methods and with a constant diet in the beautiful dissertation on this subject by W. Bain and W. Edgecombe. The administration of Kissingen Rakoczy for four days decreased the uric acid excretion in a healthy individual from an average of 0.459 grams to 0.437 grams a day. In the



next few days the excretion of uric acid rose again to 0.539 grams. It is impossible, therefore, to positively predict an increase in the uric acid excretion. It is a remarkable fact, however, and an important one, that particularly in those conditions in which we desire an increase in the uric acid excretion for therapeutic purposes, that is, in gout, this desirable effect is invariably obtained.

## V. ON THE USE OF FRUIT, SALAD, VINEGAR, ETC., IN THE COURSE OF WATER CURES.

It has been customary for some time to exclude a number of articles of diet as a matter of routine when taking a course of mineral waters. We have already spoken of fat in this respect, and must mention a number of other articles that have been declared dangerous by different physicians. The most emphatic interdiction, and the one that is most disagreeable to the patients, is the withdrawal of raw fruit; boiled fruit, on the other hand, is recommended or is at least tolerated. We have encountered the interdiction of fruit, for instance, in Kissingen, in Homburg, in Carlsbad, in Marienbad, and in a number of other watering places. The Municipal-Bath Committee in Homburg even went so far as to have the rule that fruits were to be forbidden printed on the labels of their bottles. We find that the same conditions obtain here as in the case of fat.

There are undoubtedly numerous patients who should not eat fruit, for the reason that fruit does not fit into the general dietetic regimen that they should undergo; but before forbidding fruit, one should always have definite reasons in each individual case to render this withdrawal justifiable. It is wrong to forbid fruit

simply because the patients are taking a certain kind of mineral water. Theoretically, the two agree beautifully with one another. In the course of some preliminary experiments that we performed when investigating metabolism during reduction cures, we intentionally gave large quantities of fruit to patients who at the same time were drinking abundant quantities of the different mineral waters. It was possible in the course of these investigations, when all conditions were so favorable, to supervise the cases with great accuracy, so that any, even the slightest, disturbance would have become apparent. In the course of these investigations we even went so far as to determine the nitrogen, fat, and in part the mineral salts of the dried fæces. Although we gave so much Kissingen Rakoczy and Bitter water that thin watery evacuations occurred within a few hours, we never saw the slightest deleterious influence upon the digestive processes and the general health of the patient from the use of abundant quantities of raw fruit within a few hours after the water was taken.

Since that time we have administered abundant quantities of raw fruit together with the water in a systematic and definite way in cases undergoing reduction cures, and in sufferers from chronic constipation, certain heart lesions, and nervous dyspepsia. As this regulation was given only in suitable cases, we have never seen any unfavorable results. On the contrary, we have come to the conclusion that it is well not only to permit the patients the luxury of fruit, that they

can ill miss, but that they are actually helped considerably by the use of fruit.

The same applies to the use of green salads and to vinegar. As a rule, citric acid is substituted for the latter, but we consider it very uncertain which of the two is more deleterious; in fact, as von Noorden has demonstrated in his recent dissertation on the treatment of acute inflammation of the kidneys, and on contracted kidney, citric acid is probably more harmful than acetic acid. Not a trace of the acetic acid taken by mouth appears in the urine, whereas a certain portion of the citric acid escapes oxidation in the blood and tissues, and appears in the urine. Basing on this finding, we have permitted suitable cases, contrary to the ordinary regulation, to eat salad with vinegar, and have never seen the slightest deleterious effect from this practice.

Similar statements could be made in regard to numerous other articles of food and drink, but we would merely be repeating ourselves, for the same can be said in regard to all of these articles, that the drinking of the particular mineral water *per se* does not call for the exclusion of any article of diet; only the disease itself might justify us in excluding this, that, or the other article of food. If this idea is carried out, and if the quality and the quantity of the food are regulated exclusively according to the conditions existing in each individual case, then the therapeutic application of the mineral waters becomes much broader, and the indications for their use much more general than if one

attempts to adhere to the particular kind of diet that is popular in each watering place.

The following is a summary of our most important conclusions :

1. Investigations in regard to the effect of mineral waters on metabolic processes should, if possible, be performed in subjects who are sick.

2. In numerous cases of gastric disorder, particularly in gastric catarrh, the use of saline mineral waters leads to an active and permanent increase in the production of hydrochloric acid.

3. In numerous cases of gastric disorder accompanied by hyperacidity (particularly in nervous dyspepsia) the moderate use of saline mineral waters leads to a decrease of the hydrochloric acid production and a decrease of the subjective symptoms.

4. The administration of saline mineral waters does not call for any particular diet. To adhere to such dietetic schemes as the ones arranged in the different watering places is an antiquated procedure, and one that must be considered a dogmatic method of treatment that may be deleterious to the patient. There is, above all, no reason why large quantities of fat should not be given in suitable cases to patients who are drinking certain mineral waters. Nor is there any urgent reason for forbidding the use of raw fruits, vinegar, salads, etc., in specified cases.

5. The ingestion of large quantities of saline mineral waters does not interfere with the absorption of the food; in particular, the absorption of the fats; this is

demonstrated by numerous investigations on patients.

6. The metabolism of the proteids is not increased by saline mineral waters, so that these waters can be employed even in those cases in which it is important to maintain the albumin content of the body, that is, in patients undergoing a reduction cure.

7. The excretion of uric acid is slightly increased when dilute saline mineral waters are taken. This increase in the uric acid excretion is sufficiently marked to justify the use of such waters in the treatment of uric acid retention.



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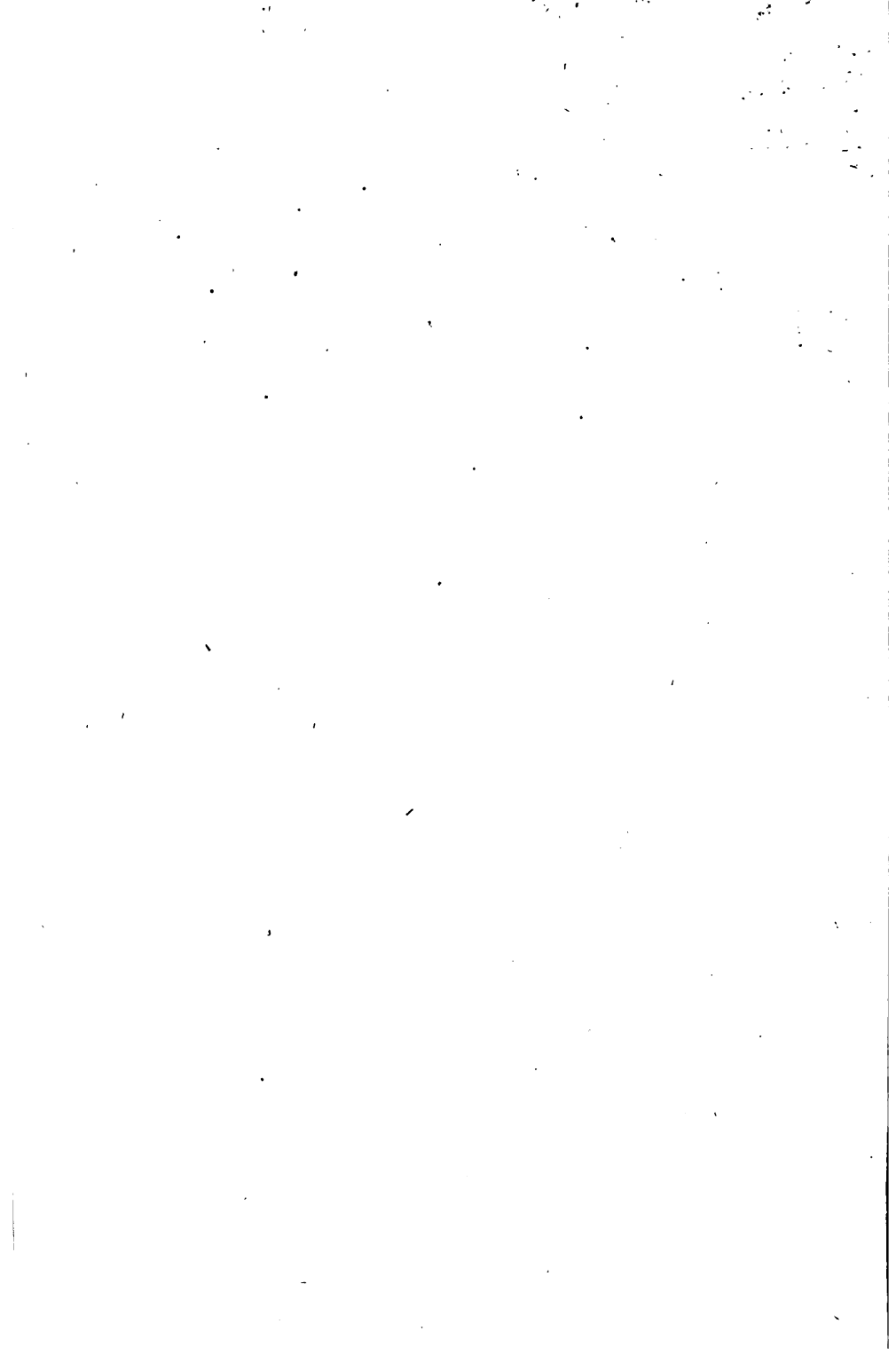
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